THE

ELECTRICAL REVIEW.

VOL. LXVI. JANUARY 21, 1910. No. 1,678.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: January 21, 1910. [No. 1,678.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKRAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

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READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A BERLY'S).

1910 EDITION READY NEXT WEEK.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE ELECTRICAL MANUFACTURERS' ASSOCIATION.

THOUGH there has been no blatant trumpet-blowing announcing its good deeds, a number of useful achievements stand to the account of the National Electrical Manufacturers' Association as the result of the past year's efforts of the new secretary (Mr. F. B. O. Hawes) and the Committee. Everybody will recognise that try all he may, an individual manufacturer cannot hope to obtain such consideration for his representations regarding unfair disadvantages under which he labours, as he and his fellow manufacturers can secure by joint effort. In large matters, where, perhaps, great principles are involved, there must be practical unanimity before real and lasting good can be accomplished, but there are a hundred minor matters in which even a small organisation—comparatively speaking—can secure benefit for its members, benefit which in many cases cannot be monopolised by those actually in association, but must inevitably be useful to outside firms, some of whom may never know, save as they see it in the Press, to whom they are indebted for the agitation which brought them advantage. Instances of this description have occurred in the course of the work of the N.E.M.A. during the past year, in such matters as railway and shipping rates, Parliamentary representation, &c. Manufacturers of metallic-filament lamps have for some time experienced trouble with the railway companies respecting damage done to lamps while in transit, and on this point the Association sent delegates to confer with the railway officials, with the result that a new classification has been decided upon for such lamps, which, we understand, amounts in practice to a reduction of 15 per cent. off the railway rates formerly imposed. The transit of recording ammeters by rail was also taken up with the Railway Clearing House, and here again the cost of carriage was reduced, while a reduction in the freight of electric lamp shades to South Africa was also obtained. The Association may also claim to have done something to benefit many firms in the industry by its endeavours to influence Parliament to retain a clause in the Electric Lighting Acts (Amendment) Bill, under which machinery which is now let out on hire to users by electric supply authorities, cannot be distrained upon. Another point of general interest arose out of an action brought against a member of the Association for insufficient notice of dismissal; the question of trade custom was that on which the case turned. The Association was able to prove that one month, and not three as claimed, was the customary notice under the circumstances related, and the Association member succeeded. A trade custom has also been established recording the allowance of cash discounts. Many firms claimed cash discounts when settling accounts which were long overdue—this is an old game of which most of us have had experience—but as the allowing of such discounts was shown to be not the

ordinary practice, it was decided to grant them, where "all goods supplied during any calendar month are due for settlement on or before the last day of the following month unless shorter terms have been arranged." Illustrative of the work of sectional committees may be named the effort of manufacturers of electric light fittings to overcome certain difficulties regarding the extended loans of fittings on sale or return, and regarding the wrongful usage of designs. The Association has kept before its members' notice the various English and foreign exhibition schemes, and it has also, as is well known, been eager in giving its help to the Electrical Trades Benevolent Institution. The Status Bureau has been doing useful work in ways that need no explaining, in conjunction with the British Traders' Association, whose solicitor members can consult free of expense, while they can also have their debts collected free of cost in England and Wales.

It seems a pity, when such an organisation as this is established in the interests of electrical manufacturers, and is doing useful work in the foregoing and a variety of other ways, that there is not a more rapid growth in its membership. The progress made during the year has been of the right kind, several well-known manufacturers having joined, and we hope further substantial additions to the membership will shortly be made. Why should not this existing Association, with all its valuable practical experience and its existing membership, form a sort of basis or nucleus, on or around which a larger organisation might be built, doing many of the things that are desired by the advocates of larger organisations? It would represent the manufacturers and traders of the United Kingdom, who have very many things in common, though, of course, they are at variance in regard to some. It would not be an Association of consumers save in so far as manufacturers saw it to be in the interests of all to satisfy the consumer; it generally is in their interests to ensure satisfaction. The manufacturer and the consumer—leaving out of consideration altogether the shareholder—cannot reasonably be expected to lie down peaceably together in one organisation. For that reason we should like to see the National Electrical Manufacturers' Association greatly strengthened in the interests of the electrical industry.

INDIA-RUBBER IN THE ELECTRICAL FIELD.

An article under the above title, which appeared in the *India-Rubber World* of January 1st, gives some interesting information concerning the use of cables insulated with india-rubber in the United States. The author, Mr. Ira W. Henry, says that the increase in the use of india-rubber for insulating purposes during the last 20 years is indicated by the fact that at the beginning of that period there were only five insulated-wire companies in America with an aggregate output of under $3,000,000 per annum, whilst now there are at least 20 manufacturers with an aggregate output exceeding $25,000,000.

So far as cables for electric light circuits are concerned, the first great increase in the trade is ascribed to the action of the New York City authorities in passing the ordinance requiring the removal of all overhead wires in certain parts of the city within a specified time; and to similar action on the part of the authorities of other big towns. In New York the passing of this ordinance was followed by protests from the electrical companies, and at a meeting held by them many prominent electrical engineers asserted that it was impossible to furnish current of sufficient voltage to light the streets with insulated wires placed underground. Such a statement reads strangely now, in the light of our present knowledge of what has since been done in the transmission of high-voltage currents by underground cables; but it must be remembered that, at that time, there was practically no experience of underground cables in America. In England, owing to the objections which have always been raised to the use of overhead wires, we were somewhat more advanced; rubber cables drawn into pipes were used in 1884 at Hastings for the Brush series system of lighting at 1,600 volts, and at Eastbourne about the same time for transmitting current at 2,000 volts. When the public supply of current was commenced in London and elsewhere after the passing of the Act of 1888, the undertakers were obliged to use underground cables, and rubber cables drawn into cast-iron pipes were laid in connection with the old Grosvenor Gallery installation, by the House-to-House Co. at West Brompton, by the Metropolitan Electric Supply Co. and by the Newcastle and District Co., all for use on high-tension alternating-current systems.

The method of covering the conductor with rubber which was adopted by the earlier American companies was that employed in England, and consisted of laying two longitudinal strips of rubber, one above and one below the conductor, and pressing them round the conductor, and making longitudinal joints by passing the conductor and rubber strips between semicircular rolls; but a little later another method was largely adopted in the United States, in which the rubber was fed into a screw machine, which forced it in a compact and seamless mass around the conductor as it emerged from a die. This method, although in regular use in England for coating conductors with gutta-percha, has never been largely used for putting on rubber insulation; but it is said to have proved very satisfactory in America, where it has been used not only for the manufacture of lighting cables, but also for making the core of submarine cables.

The first submarine cable, with a rubber-insulated core of this kind, to be put into successful operation was laid during the Spanish-American War to connect Cuba with the mainland, and consisted of a stranded copper conductor insulated with a pure rubber jacket, over which was placed a thicker layer of vulcanised rubber, this core being afterwards protected by armouring in the usual way. This cable was so satisfactory that a similar type was adopted for a network of submarine cables totalling over 2,000 miles in length, which was laid to connect various parts of the Philippine Islands with the American headquarters at Manila; and it is stated that these cables have worked perfectly under most trying conditions, and have proved their suitability for use in tropical regions. Another extensive system of cables with rubber-insulated cores has been laid to connect various points in Alaska with Seattle, in the State of Washington, and these cables, which are working in a very cold climate, are also reported to be giving every satisfaction. Before asking for tenders for these cables, tests were made on india-rubber and gutta-percha under conditions as nearly comparing with the Alaskan climate as could be artificially produced in the laboratory, and the result proved much in favour of india-rubber. Although rubber-insulated submarine cables were made by Hooper some 40 years ago, and several thousand miles of cable have been made with Hooper's core or on similar lines, yet amongst English manufacturers the gutta-percha core has always remained the standard, and it would be interesting to know more fully the reasons which have led the United States War Department to the conclusion that the rubber cable is the better.

One other interesting example of the use of rubber cable is mentioned, where it was used for landlines in Alaska. When, after the discovery of gold in the Klondike, the United States Government had to connect their up-country military posts by telegraph, poles could not be procured locally and the cost of transport was prohibitive, so it was decided to use a rubber-insulated cable, and lay it on the surface of the snow-covered ground. The wire was placed on reels strapped to dog sledges, and was paid out in the most direct line possible, and in many cases it soon became buried under snow and ice. As it is reported that communication has been well maintained, it would appear that a rubber-insulated cable has proved its value both for land-lines and for submarine work under extreme conditions of temperature, either in tropical or semi-arctic regions, and that it may become a more serious rival than hitherto to the gutta-percha cable, as soon as the price of rubber falls to a more moderate figure.

The Second Kelvin Lecture.

The memory of Lord Kelvin is one of the most inspiring incentives which the British engineer, and especially the British electrical engineer, possesses. It was therefore fitting that the Institution of Electrical Engineers, which Lord Kelvin did so much to help, and of which he was for the third time President at the time of his death, should found a Lectureship to commemorate his work. Prof. Silvanus Thompson in the inaugural lecture gave a general *résumé* of his life, and now Prof. Ewing in the second lecture, devotes special attention to one aspect of his many-sided activities. Few could have dealt better with the particular subject chosen, for Prof. Ewing acted as assistant in many of the researches connected with it. Like all who came into close contact with Lord Kelvin, he fell under the spell of his goodness and his greatness, and the testimony borne in the lecture to the memory of a hero is eloquent of the magnetic personality of the great genius.

Leaving to others the task of following Lord Kelvin into the abstruse mathematical theories that he loved to work out, Prof. Ewing dealt with the practical inventions which have made submarine telegraphy over long distances practicable, and have done so much to render the task of the navigator lighter and safer than before. The story of the laying of the Atlantic cable—its failures and final success—was retold, the share of Lord Kelvin—then Prof. William Thomson—in the work needed to overcome the many difficulties was recalled. The mirror galvanometer, the siphon recorder, the many improvements which he suggested in the cable-laying machinery, form only a part of the debt which submarine telegraphy owes to him. Prof. Ewing referred to his association with Cromwell Varley and Fleeming Jenkin, and introduced several pleasing reminiscences of this period of his life, which Mrs. Fleeming Jenkin had kindly supplied, throwing a welcome sidelight on his unfailing courtesy and lovable nature.

In 1873 Lord Kelvin's attention was directed to the mariner's compass partly by a promise he had made to write an article on it for *Good Words*. The first instalment appeared in 1874, the second in 1879. It was characteristic of the man that finding out the defects from which existing instruments suffered, he should set himself to remove them before giving further publicity to their shortcomings.

During this period many of those inventions were perfected, which have made the mariner's compass thoroughly reliable under all pos-ible conditions, and have given a new sense of security to the sailor. The remark which a bluejacket was once overheard to make, "I don't know who this Thomson may be, but every sailor ought to pray for him every night," was a grand tribute to the humanitarian result of his efforts.

The complicated character of the difficulties Lord Kelvin had to overcome when working out these improvements was detailed by the lecturer, who concluded with a reference to the machine Lord Kelvin invented for predicting the tide times at particular ports for any period, showing a record prepared by one of these machines at the National Physical Laboratory for the tide times for the port of Aden for part of the year 1912.

The lecture must be read in its entirety if one would realise the extent and importance of the work of Lord Kelvin in the domains surveyed in the lecture.

Flexible Cord and Insurance Companies.

In our issue of December 24th, in commenting on the disastrous and lamentable fire at Messrs. Arding & Hobbs's premises, we said, "it is high time that the use of flexible cord in shop windows containing inflammable articles . . . . should be absolutely prohibited." We are pleased to note that our advice has not fallen upon deaf ears, and that insurance companies are taking the matter up vigorously. We have just received a copy of the latest edition of the Phœnix Fire Office Rules, and we must congratulate the company on having lost no time in introducing into these rules certain amendments relating to the use of flexible cords.

Rule 9, which deals with flexible wires and cords, has been amplified as follows:—

"Flexible cords, except when used in connection with pendant lamps hung well clear of material, must not be used in shop windows containing inflammable goods."

Words to the same effect have also been introduced into Rule 43, which deals with special risks. Under the heading "Drapers' shops, warehouses, stores, &c.," a sub-title "Shop windows" has been added under which the above restriction is printed.

The dangers arising from the heat of the lamps themselves are also recognised, and the Shop Window Rule states that all lamps must be so fixed that there shall be no possibility of inflammable material being set on fire through breakage of the lamps.

Again, under the heading "Temporary installations" (Rule 45), the same points are emphasised, and flexible cord is prohibited.

We commented generally upon the improvements introduced into the Phœnix Rules when the previous edition was issued, and we are pleased to note that the Phœnix Fire Office is keeping well abreast of the times.

In other directions the only important addition is in connection with conductors (Rule 2), in which a stretching test has been introduced for rubber insulation. According to the Rule as it now stands, "the dielectric after being stretched to three times its own length for 24 hours at normal temperature, shall return to within 15 per cent. of its original length within one hour."

In the introductory matter, intending users are cautioned against the jerry wiring contractor, and are advised to retain the services of advising engineers to design and supervise the erection of the electrical work, and not only so, but to have it periodically inspected by a competent engineer.

As we have on many occasions before pointed out, we are no advocates of a multiplicity of wiring rules, and we were at one time inclined to the opinion that the Phœnix Co. should have thrown in their lot with the other companies who have adopted the Institution Rules. We can see, however, that there is this advantage in the Phœnix Fire Office continuing its original policy of issuing its own set of rules, that the rules can be more quickly modified to meet new conditions than is possible in the case of the Institution Rules.

Copper.

The *Financial Times* article of 13th inst., commenting on the returns issued by the American Copper Producers' Association, anticipates on the whole an upward tendency in prices. The statistics referred to are, of course, for the United States, and are instructive as set forth in tabular form, showing an average production per month of 53,050 tons (highest, November, 54,294 tons; lowest, February, 46,295) and average deliveries 51,465 (highest, July, 67,201; lowest, February, 33,280). The stocks carried in the States have varied from 81,785 tons (April) to 63,288 (December) in the last month; production is again down, while deliveries have risen 3,098 tons, as against November. Stocks have been reduced in proportion. These were at their highest in April last, and, of course, their reduction has been coincident with the growth of European stocks.

The Copper Producers' Association give the U.S. consumption for the 12 months at 617,594 tons, against output 626,069 tons. Respecting this, the *Financial Times* article draws attention to the fact that European stocks have almost doubled, being 109,000 tons at the end of 1909, as compared with 55,600 tons at the end of 1908.

With reference to the combine the article inclines to the opinion that minor combinations are being effected, with the view, probably, of ultimately welding up the various parts.

To what extent the trade revival in America will spread over here it is difficult to estimate until the present political disturbance is over. Obviously, more settled conditions will have a beneficial influence on commercial activity.

ELECTRICAL UNDERTAKINGS AND THE LAW OF RATING.

I.—The Rating of Electric Lighting and Power Companies.

Before very long all the electric lighting authorities in the metropolis will have to seriously consider the many questions which must arise in connection with rating property for the relief of the poor. Unlike the rest of the country, the metropolis is in the position of only having a revaluation once every five years, and the last revaluation took place in 1905.

It may be found useful if we discuss some of the principles upon which the property of electric lighting companies is rated, with a view to enabling interested persons to ascertain whether, in the light of events during the last five years, their valuation is likely to go up or down.

The law of rating is by no means simple. This is partly due to the fact that Parliament does not define rateable value, and has never attempted to do so. All the Legislature has ever done is to prescribe the means by which rateable value may be estimated. Seeing that the last Act dealing with the subject was passed so long ago as 1862, it is not surprising that it contains no reference to electricity or electric lighting undertakings.

We must indeed go back to first principles in order to ascertain the law of rating. The Parochial Assessments Act, 1836, provides that a rate must be "made upon an estimate of the net annual value of the several hereditaments rated thereunto; that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes . . . . if any, and deducting therefrom the probable average annual cost of the repairs, insurance and other expenses, if any, necessary to maintain them in a state to command such rent."

As such a person as an actual "tenant" of an electric lighting undertaking is a creature unknown, it has long been the practice, in rating gas companies and similar undertakings, to have regard to the profits which such a concern would bring in. Three leading principles of law are as follows:—

(*a*) In valuing the works, pipes, &c., of an electric lighting company for the purposes of rating, the profits earned by the company are taken into account.

(*b*) The exercise of the right to lay down wires and send electricity through them, amounts to an occupation in law, so as to be rateable.

(*c*) If the electric lighting works belong to a municipal corporation or other local authority, that body is rateable, although the profits earned are devoted to public purposes.

Let us now examine the method by which the rating authorities endeavour to ascertain the hypothetical rent.

The first step is to ascertain the net receipts. This is done by taking the receipts of the company from every source, and subtracting therefrom the ordinary working expenses (other than the cost of repairs, insurance, &c., which come in later on). Having ascertained the net receipts, it is necessary to inquire how much of them a tenant will be willing to pay as rent to a hypothetical landlord. He would not, of course, pay the whole receipts as rent, as he would not then have any incentive to embark on the undertaking. There must be a deduction for "tenant's profit," sometimes called "tenant's share." It is worked out as a percentage on the tenant's capital. The tenant's capital is the value of his loose stock-in-trade, and a sufficient capital sum to enable him to provide for working expenses. It would not, of course, include the value of the boilers, engines, dynamos or other fixed machinery at the central station, but it would include the meters on consumers' premises, and all the loose tools, &c. A percentage is then taken on the tenant's capital, and considerable difficulty is often experienced in deciding what this should be. At the London Quarter Sessions the usual practice in rating the property of a gas company is to take 5 per cent. for interest, 10 per cent. for trade profits, and 2½ per cent. for risks and casualties, making 17½ per cent. in all.

Having deducted the tenant's profit, we arrive at the *gross value* of the undertaking. According to the rule laid down in the statute (*supra*), the cost of repairs, renewals and insurance sufficient to maintain the hereditament in a state to command the rent must be deducted from this, inasmuch as these charges fall on the hypothetical landlord. Making a final deduction of the rates, which the tenant has to pay, we arrive at the rateable value of the whole undertaking.

The above principles of rating can be best understood by looking at the following figures, which were given by Mr. Harold Eve in the course of the case of Charing Cross Electricity Supply Co., Ltd., *v.* Lambeth and Westminster Assessment Committee in 1906:—

Ascertainment of Rateable Value.

Gross receipts	£125,194
Working expenses	50,281
Net receipts	£74,913
Tenants' share, 17½ per cent. on £51,000 ...	£8,925
Gross value, plus rates	£65,988
Repairs and renewals	27,341
Rateable value, plus rates	£38,647
Rates, at 7s. in the £	10,020
Rateable value of whole undertaking	£28,627

In London, as the rates are only revised once in five years, it is necessary to consider what year is to be looked at for the purposes of rating.

In Charing Cross, City and West End Electricity Supply Co., Ltd. *v.* City of London Union ((1906) Konstam, 31) the company appealed against a valuation made in 1905. The question arose as to what year was to be considered. The company published their accounts yearly—not half-yearly. It was held that the case must proceed on the basis of the company's accounts for the year 1904; but counsel for the Union were to be allowed to put questions as to the general working of the company in 1905. The Deputy-Chairman of the Quarter Sessions said: "Sir E. Boyle (counsel for the Union) must refer only to the general results of 1905, and not to the precise figures. An electric supply undertaking is not like an ordinary business; some other light may spring up immediately and take the place of electric light."

Hitherto we have proceeded upon the assumption that the entire undertaking of the company is situated in one parish or rating area. In such a case there is no necessity to consider whether the profits, upon which the rateable value is founded, are earned at the generating station or at the premises of the various consumers. But where, as nearly always happens, the undertaking is distributed over many parishes, difficult questions arise. For instance, the generating station, which is only indirectly productive, may be in one parish, while the directly productive part of the works may be distributed over the company's whole area. How are the profits to be apportioned? The difficulty is got over by considering the claims of all the different rating areas together.

In dealing with this question, rating authorities have recognised the fact that the undertaking of a gas or a water company is very similar to that of an electric lighting company. The principle adopted in the case of a water company was laid down in 1847 in the case of R. *v.* Overseers of Mile End Old Town, 1847, 10 Q.B., 208. There the works of a water company extended into several parishes. The rateable value for the purposes of poor rate, of the entire works, was £30,800. The rateable value of the reservoirs, buildings, &c., valued as land and buildings deriving value from their capacity of being applied to the objects of a water company was £6,500. It was held that the rateable value ought to be apportioned among the several parishes in the following manner:—The rateable value of the reservoirs, buildings, &c., valued as above, to be first deducted from the total rateable value, and distributed among the parishes in which this portion of the works was situate, according to the extent of such works in each parish; and the residue of the rateable value to be apportioned among the parishes containing the service pipes, in the ratio of the net profits produced in each of those parishes.

The application of the principle of this case was illustrated in the assessment of the property of the Charing Cross Elec-

tricity Supply Co. (see Konstam's Rating Appeals, page 22). The company had a generating station and mains in the parish of Lambeth, but they did not supply electricity in that parish. They supplied electricity in all the parishes of the City of Westminster, in respect of which there was an appeal, and elsewhere. The greater part of the electricity supplied by the company in Westminster, was brought by them from the generating station in Lambeth, but a part was brought from another generating station at Bow. The company had a sub-station situated partly in the parish of St. Martin-in-the-Fields, and another sub-station wholly in the parish of St. Martin-in-the-Fields, besides sub-stations elsewhere. The property in Lambeth, therefore, consisted entirely of indirectly productive works, and that in Westminster partly of directly and partly of indirectly productive works. The capital value or the indirectly productive portion was estimated at £543,666, and of the directly productive portion at £314,696. In the event, the generating station and mains in Lambeth were estimated at £16,106, with a rateable value of £8,053, while the other properties in the Westminster parishes were estimated at £35,559 gross, and £19,000 rateable.

Unfortunately for those whose duty it may be to ascertain the rateable value of electric light works in the future, the report of this case gives but a vague idea of the method adopted in arriving at the figures. Nevertheless, the following conflicting figures with regard to repairs and renewals are of interest. Mr. Patchell stated that, in his opinion, the proper amounts to be set apart annually for renewals were, in the case of—

Mains, 3 per cent. on the capital value.		
Buildings, 1½ per cent.	"	"
Accumulators, 10 per cent.	"	"
Other plant, 5 per cent.	"	"

Major Cardew, however, who gave evidence for the rating authorities, said that the proper allowance for repairs and renewals of accumulators was 8½ per cent. of their value. The mains had, in his opinion, an average life of 40 years, and would be worth 12 per cent. of their prime cost at the end of that time. The sinking fund necessary to replace them would be 1·14 per cent. of their value, and not more than 2 per cent. would be necessary for the annual repair of the mains. Unfortunately, the report of the case to which we have been referring does not state which of these two sets of figures were acted on by the rating authority.

Rating of Works in Excess of Existing Requirements.—It often happens that electrical undertakers have extra space, and sometimes spare plant, which is in excess of their existing requirements, and is laid down for the purpose of meeting extensions in future years. The question whether this part of the property is to be brought into rating has been considered in a number of cases, but not electric supply cases. In R. *v.* South Stafford Waterworks, 1885, 16 Q.B.D. 359, the indirectly productive works were largely in excess of the then existing requirements of the company, and had been constructed for use in future years. The rateable value of the whole system was agreed, the point in dispute being the proper amount of deduction to be made therefrom. It was found that if only so much of the permanent works as was required for the purposes of the present supply was brought into rating, the rateable value of the whole would be materially diminished. The following passage from Lord Esher's judgment in the Court of Appeal serves to show the attitude taken up by the Court :—

"There might be works of the undertaking which had not become part of the actual system, as, for instance, a reservoir or a second lot of engines not yet used at all, but constructed with the view of becoming part of the works in the future. Such could be no part of the existing system of works, but would be intended for another system, and would, of course, be rejected in making the calculation. But that is not the case, for here every part of the works is in actual use, though they are too large for the supply of water at present required. . . . But as the works in use are in excess of the present requirement, a tenant taking the whole or part of the property in a particular parish ought not in justice to be asked to pay the same rate of rent as he would if all the works were earning profit. Therefore, if the 3¼ per cent. mentioned by the arbitrator is the ordinary percentage upon the value of the capital laid out, one would think that the percentage in this case should be reduced to 3 per cent. or less." It would seem from this case that it would be perfectly proper for a rating authority to make a reduction on account of the spare space inside a generating station. The question whether there could be a reduction for a spare "set" is rather different, because prudent people would not run a large station and undertake to give a continuous supply without making provision for breakdown.

Whether a Local Authority are the Undertakers.—It was at one time thought that if a municipal corporation or other similar body occupied land, and the whole of the profits of the corporation were by statute devoted to public purposes, the corporation had no beneficial occupation and were not rateable. This, however, is an erroneous view, and all such property now comes into rating, although, as the local authority has to spend the rates, or a greater part of them, the money is to a large extent taken out of one pocket only to be put in another.

NOTES ON TRADE ABROAD.

Our Electrical Export Trade.

SOME of our contemporaries have repeatedly sought to belittle the attitude of the ELECTRICAL REVIEW regarding electrical exporting. The reader does not need to be told now what that policy is, though we may be allowed to say that we never felt more favourably impressed than we do now with the value to the British electrical industry of the opportunities that are presented to us by the great world development movement that is proceeding everywhere. For 10 years and more we have thought it to be our duty to urge our firms to enlarge their vision and spread their business enterprise and trade effort over a wider area. We have adopted this course apart altogether from any discussion on questions of fiscal policy; we commenced it before the public attention was turned to that controversy, and whatever may be the future of the nation in that respect, we shall continue to do our utmost to encourage further progress in British electrical exporting. The humorists have wagged their heads, and in their attempts at criticism have thought to bring our policy into derision by describing our watchword as "Go to the Antipodes!" We welcome the clause, and are particularly happy in remembering it just now when we consider how much employment must have been brought to British workmen and electrical manufacturers and traders in 1909 by the record exports of British electrical manufactures to all parts of the world. There has been more benefit brought to the people of the United Kingdom by this policy than by all the "stay-at-home and squabble" watchword of those who tried to discredit our advice. There are still within our office drawers copies of bold announcements regarding what such and such a paper was going to do in its reorganised form, one of the loudest promises being regarding a brave effort that was to be made to furnish electrical readers in general, and the trade in particular, with exceptionally valuable information regarding the openings for electrical business in other parts of the world—we presume "the Antipodes" among them. We knew from long experience something of the difficulty in that direction, and it was no surprise to us to observe such promises fail of fulfilment, though it has somewhat surprised us to hear the disgruntled reflection, as it was intended to be, of "go to the Antipodes," issue from the unsuccessful quarter. If any ELECTRICAL REVIEW readers have ever been impressed by such reflection, we hope that they will now be able to evaluate the opinion which influenced it at its correct worth. Furthermore, though there may not be an actual *volte face* as the wisdom of our policy is more and more justified in the light of experience, there will, or we are greatly mistaken, have to be a gradual coming into line with ourselves step by step in this matter, unless a policy quite adverse to the best interests of the electrical trade is to be continued. We welcome, purely because we think it to be correct, the advancing attitude

of one of our contemporaries, as reflected in the pages of its last week's issue, where the imports and exports of electrical manufactures receive a good deal of attention, the declining imports and increasing exports, after fair consideration, being made the cause of rejoicing. Our contemporary even goes so far as to predict a further fall in imports (this, of course, is to be expected, partly from the greater manufacturing capacity of our metallic-filament lamp makers) and a continuous rise in exports. Too often have we seen it written by those who have had little or no trading experience, that to go abroad is too costly an undertaking for our electrical firms, and that the only way to build up an export trade was to first establish and secure a good home trade. Now we are told that "a couple of years ago more than one firm decided to apply its chief energies to securing foreign contracts on the ground that over-competition in an attenuated home market has reduced home prices to an unprofitable level." Here, then, we have the two statements: (1) that you cannot do a good export business without you first have a successful home trade; (2) that when you have an unsuccessful home trade it is good policy to devote your chief attention to building up an export business. We are quite content to leave the two statements there and to believe that they amply justify our position that, whether your home trade is booming or flagging, it is correct policy to go to the Antipodes and to every other foreign market, where there is a ghost of a chance for you, in search of new business. Last year our electrical imports were approximately £2,000,000 mainly for home consumption, and our exports were in the neighbourhood of £4,000,000, nearly all of them of British manufacture. By all means, then, let us go to the Antipodes, and the more we supply there, the more likely are we to be able to so manufacture as to meet competition in the home market and reduce the importation of such goods as we are able to make already, and by getting business of a new kind that we do not now undertake, we may be able to render unnecessary the importation of some special lines which we have no alternative but to import at present, whatever the price may be. That may not be the course that some might desire, or which they would have adopted had things been different, but with the manufacturing situation what it is, and also with foreign competition as it is, we believe it is the best course to pursue under all the circumstances. We are glad to see that our contemporary is so greatly impressed with the "rapidly growing demand throughout the whole of the civilised, and part of the uncivilised world," and we are pleased to agree with it in saying what we have said a good many times already in other words, that "our export trade ought to reach great dimensions during the next few years."

Our Progress in Siam.

Now let us get down to what is happening in one of the foreign countries to which we have not recently alluded in any detail, and consider the headway that the British electrical manufacturer has made during the last year or two, in the presence of Continental and trans-Atlantic competition in meeting its requirements. The authority for what we are using as the basis of our comment is American, and after our exposure of the grossly incorrect figures given by an American Consul concerning the relative positions of British and American electrical standing in the Indian market, it will not be supposed that an American statement of the American position anywhere is under-estimated. There have been some very big things said about the trading designs that America has on China and the Far East, but, knowing the American characteristic, none of our electrical manufacturers are likely to quail perceptibly; however, there is no justification for slumber because we have been doing well. Certainly the figures that are given below relating to Siam furnish no reason for despondency. It is true that the percentage increase of American exports is greater than our own, but when the increase is on so small a sum as £800 odd (the 1908 figure), percentage of improvement counts for little. The increase was 350 per cent. on £800, against our rate of 247 per cent. on £6,500 (the 1908 figure). In exact figures America did $14,526 more business, while we did $80,527 more. We hope that as the result of this larger business that we have done we may gain a securer hold on the market, and may not suffer even in percentage comparison with the States when the next figures are issued. Germany, if these statistics may be regarded as safe to draw deductions of a general kind from, has slackened her hold on Siam electrically, or, at any rate, has made a far slower rate of advance than we have. Her increase is only 43 per cent. on the 1908 figure ($23,775 on $55,306), a very respectable advance in the ordinary course, but poor comparatively with the advance of other countries in this particular year. An interesting factor in the position is the appearance of Sweden as an exporter to Siam with over £10,000 as compared with nothing in the previous year. We have already understood from the Canadian market that Sweden is an electrical exporting country with which we have to reckon in our wonderful western colony, and if she is making her competitive influence felt elsewhere as she has done there, and is, from these figures, doing in the Far East, she will count in the race for the markets of the world. We gather, however, that in this particular instance the Swedish business consisted chiefly of the setting up by a Stockholm firm, on behalf of the Siamese Government, of a new telephone installation for 1,500 subscribers on the central battery system. This installation obtains its power from the Siam Electricity Co. (100 volts, 100 cycles, single-phase) and two sets of motor-generators.

Siamese Electrical Imports.

	1908.	1909.
United States	$4,146	$18,672
United Kingdom	32,557	113,084
Germany	55,306	79,081
Sweden	—	52,222
Denmark	14,497	15,523
All other countries ...	9,034	20,463
Total	$115,540	$299,045

It may be of interest here to give a word or two with reference to the undertaking of the Siam Electricity Co. This is a Danish company, which supplies Bangkok with light and power, and makes a very good financial return on its operations—its last dividend was at the rate of 12 per cent. per annum, plus a bonus of $1.50 on shares originally issued at about $50 each, but now quoted in the market at about $180. Its capital investment is $1,500,000. No doubt it is largely due to the fact that it is a Danish company that Denmark ranks as an exporter nearly as high as America, though her volume or value is about the same for the two years. The company began its operations many years ago (1890), and it is the only electric supply company in Siam; it furnishes public and private light and power in Bangkok, and supplies power for 25 miles of electric trolley tramway. Its equipment comprises Babcock boilers, Brush compound engines, B. & W. (Ball & Wood ?) triple-expansion engines; Curtis turbine, and others; Morley, G.E.C., Short, and other dynamos; Terrarie (? Ferraris), Thompson, G.E.C., and other motors. The Siamese Government owns and operates the telegraph system, as well as the telephones already alluded to, but there is no wireless telegraphic communication in operation so far.

As the Siam Co. is the only one supplying electricity in Siam, so Bangkok is the only place where this illuminating agent is in vogue. Even there kerosene furnishes the majority of the population with their light. Coal being scarce, gas is not used. Kerosene (partly imported) is comparatively cheap, therefore oil engines are much in vogue. Great Britain furnishes large quantities of lubricating oils. The American Consul of Bangkok has lately reported to his countrymen in the States upon the cities, travel routes and commerce of Northern Siam, which is the hilly and mountainous region. The electrical "commercial" will not find very much business doing in these parts yet. The northern region is very difficult to reach; the journey is done partly by rail and partly by horse and native carriers, and travel overland has to be done in the dry season, between December and April. Its population is in the neighbourhood of two millions, and its chief imports consist of provisions and general goods, which are passed up the river from Bangkok by 1,000 boats, each of which carry about 3 tons, and make four or five trips per year. Bangkok, in the great plain of the south, is the chief electrical centre in the present state of the country's development.

For the benefit of British exporters, we may mention that there is a uniform duty on all electrical goods of 3 per cent. *ad valorem*, and may quote the following paragraph from the report of the American Vice-Consul at Bangkok :—

Bangkok affords a good market for electrical toys of every description. Electric fans, chafing dishes, water-heating kettles, sad-irons, batteries, bells, and masseurs are beginning to find a market, but as yet the many uses to which electricity may be put remain to be demonstrated to the people of Siam, especially to the people in the north of Siam, where it is practically unknown.

We will express the hope that the British manufacturer will continue to watch over the electrical interests of Siam, and that the excellent progress indicated in the figures quoted from above will convince him that having done so well with past effort, he may do very much better by devoting attention still more zealously to this particular market. And if he is doing it in Siam, what is to prevent him from doing it in most other places ? Electrical needs are increasing everywhere, and nothing can prevent a continuance of that increase.

DIGNITY AS A BUSINESS ASSET.

By T. W. COLE.

Napoleon in search of an invective is a sight calculated to provoke curiosity. That he should have found his desideratum of abuse in the word "shopkeeper" is worthy of interest. "The English are a nation of—shopkeepers!" quoth he, in fine endeavour after virulence. The fact that the intended invective comes to our ears shorn of some of its purposed bitterness is probably due to our more happy experience of the worthy class to which he refers. At the same time there is something to be said in justification of the scorn which thus traditionally clings to this inoffensive class of citizen. The "shopkeeping" mind unequal to maintaining the true ring of courtesy has translated it into the degenerate equivalent—servility. Good humour it replaces by jocoseness—and with this debased coinage makes bid for public favour. But (and here is the topical point of the foregoing) there is nowadays a kind of "gentlemen-ranker" who falls into line with the rank and file, albeit coming from a class differing in traditions. For instance, you can go to the establishment of an illustrious peer to be served with a motor-car. And is there not an "Eton and Christchurch" man who dispenses at request due quotas of electricity in return for the humblest of pence? Thus, indeed, is shopkeeping uplifted to a new dignity. But alas! evil company corrupteth good manners; and the primal taint of shopkeeping—which gave what point there was to the Napoleonic utterance—seems just lately, at least in one branch of industry, to be spreading upward in quite epidemic fashion, and upwards, too, among just the people who should be lending dignity to trade. It seems quite in the fashion nowadays for quite reputable electrical factors and merchants and companies of various sorts to cut all sorts of undignified capers in order to attract the passing attention. The "Buy, buy, buy" of the Saturday night butcher is a direct business-like appeal. But the latter-day mountebank quip, uttered so lugubriously by certain elderly and sedate firms of the electrical persuasion has nothing in common with this. Blatant bawling is not commendable perhaps in every business situation, but, at any rate, it has a decided advantage over jocose senility. "Standing" in a firm is an equivalent of age in a person, and each is forbidding of certain unbecoming postures. And yet we could name an instance, as a salient example, of a firm that not only had dignified standing, but, moreover, delighted in that most coveted of non-titular distinctions—a hyphened name—gravely setting itself a-hornpiping, as if to the tune of "Throw me a copper, kind sir!" An ingenious analysis might possibly discover that the progenitor of this idea of a flabby jocoseness being necessary to business-getting, was the once-so-firm conviction that the royal road to "engineer" transactions lay in maudlin "good-fellowship," lounging over a bedabbled bar-counter.

If, however, it could be claimed that these methods were conducive to business-getting, they would be justified. But the electrical industry throughout is a *serious* one. To obtain a client's confidence (whether the client in view be a technical man, or one of the public) is the first indispensable condition. And it could not be seriously maintained that any procedure which is undignified, leads to that end, directly or indirectly. Further, a firm or company cannot do these things with impunity—that is, it is not a case where non-success merely means that the position is just the same as before. It means more. It means that an asset has been lost—and this asset is the dignity of the firm or company. Dignity invites and retains confidence—and confidence is the indispensable basis of all continuous business transactions. It becomes, therefore, a valuable business asset, and not one to be lightly or whimsically endangered.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Interconnection of Engineering Societies.

Engineering in its progress has been divided into numerous branches which, as time passes, become more and more defined and distinct. In consequence, there has appeared from time to time the necessity of forming new societies in order to give adequate attention to the details of the respective branches. The founders of new societies are naturally inspired in their work by the opinion that their objects cannot be obtained from any existing society. There is, however, a great danger that, in their enthusiasm, they may overlook the fact that some other societies have similar objects, and that they might strengthen their cause by recognising the value of the sympathy and influence of such societies. All technical engineering societies have at least one object in common, *i.e.*, "To direct the great sources of power in nature for the use and convenience of man," and this ideal should of itself be sufficient to ensure a common interest and harmony.

There is also a danger of misunderstanding arising between new and existing societies. A dignified interest on one part might, on account of insufficient opportunity for discussion and explanations, be mistaken for an unwarranted intrusion or interference.

The engineering industry is a busy one and has, as a rule, very little time to spare for the discussion of social questions. Individuals leave such affairs alone probably under the impression that somebody else will attend to them. Would it not, therefore, be a good policy for one of the great existing institutions to form a small advisory board whose privilege it would be to confer with other bodies and to form, as it were, an "Interconnector" between them? It would be formed of experienced men with a knowledge of the objects of all existing societies and institutions who, having authority to approach the founders of any new movement and interest themselves in its objects, could do much to prevent the clashing of interests, and thereby advance the science of engineering.

The Institution of Civil Engineers embraces all branches of engineering in one powerful society and is, therefore, in the best position to form a board to act as mediators.

Those who have attended meetings of the new society which is at present called "The Institution of Mining Electrical Engineers," will recognise that the writer has them in mind in making the above suggestion. To those who were not present it is sufficient to say that a diversity of opinion existed on a suggestion to modify the title into "Electrical Mining Society," or some other title which would be less likely to be confused with the title of the parent Institution of Electrical Engineers.

The objects of the new society have been clearly defined and explained in the technical Press, and it is plain that they are not entirely covered by other great mining institutions or by the Institution of Electrical Engineers. They aim at the education and advancement of the engineer in charge of elec-

trical plant in mines, and also the education of manufacturers, mining engineers, and managers, in matters relating to the electrical requirements, specifically of mines.

Whilst many individuals thus affected are engineers who are members of the existing technical societies, there are others who, by reason of previous training, would not be eligible for election into the established institutions. But as it is one of the primary objects of the new society to induce men to qualify as capable electrical engineers for mines by study and examination, there is every reason to expect that it will eventually be a training ground for the older Institutions.

It is suggested that an advisory board to act as an interconnection between Engineering Technical Societies could at the present time do much good service, and the movement in connection with electricity in mines is a case in point requiring immediate consideration.

H. W. C.

Methods and Practice in the German Electrical Industry.

In "Zähler's" letter appearing in yours of the 7th, I detect a covert impertinence in the suggestion that I should confine myself to that of which I know something. If the character and magnitude of one's own business are to be the measure of one's ability to discuss questions of general importance, then I hope to be at least as interesting as my opponent.

In response to his request, I will give some particulars of the business of which I have "intimate knowledge," if you will grant me the space; but I have no doubt that if I had volunteered information about my own business I should have been charged with being blinded by self-interest.

In France I have had to arrange for the manufacture of our meters on royalty; the duty makes importation quite impossible. Thus the tariff operates to force us to employ Frenchmen, while the work of Frenchmen on similar articles is daily imported into this country to the prejudice of English meter makers.

In Germany we do a small import business, but we find the prices lower than they are in England, which we have to accept, and out of which we have to pay the cost of all those barriers which geographical conditions and tariffs impose upon us. These two cases will suffice.

Now, perhaps, "Zähler" will tell us his experience in Germany.

"Zähler" denies that our unemployed are increasing every day, and for proof he refers me, I presume, to the Trade Union returns. These are simply the aristocracy of our working population. What about our teeming workhouses? What about the army of unemployables scattered over the country? What about the vast army living on starvation wages due to foreign competition? And what about the 200,000 of the best that we breed, exported annually to the protected countries of the world, where they quickly become our keenest competitors? Are not these England's unemployed? Beside this appalling fact, "Zähler's" figures become as pettifogging as the theories which he bases upon them.

I accept "Zähler's" figures, and ask where is his remedy for unemployment. Where is the justification for spending our wealth abroad to the extent of £150,000,000 annually on foreign manufactured goods, to say nothing of £170,000,000 on food, a great deal of which might be produced at home, to our greater security. I admit wealth can only come into the country in the form of goods and go out as goods, but it need not necessarily come in at all. We can make the goods ourselves, and so accelerate the process of increasing our foreign investments.

What is the objection to using a tariff for the purpose of causing goods inward to be raw material and goods outward finished goods? Is "Zähler" afraid of our becoming what Richard Cobden thought he could make us—the workshop of the world?

I admit that we are getting more wealthy every year. There is nothing in the life of a nation which has not its parallel in the life of an individual. An individual may be getting more wealthy while rapidly approaching his end.

We have been guilty for the last half century of a great national laziness—a crass and stupid injustice to our own people—and now that we are waking up to the fact, it is being disputed by men who, like "Zähler," think they have proved that Free Foreign Trade is right when they show that we can afford it.

I am not content that we should become a small nation of money-lenders. I want this nation to become a great Empire of fighters, producers, manufacturers and distributers, and if "Zähler" or anyone else hopes to show me that I am going the wrong way about it, they must discard Free Trade theories, which have no relevance to present conditions, and show me some concrete examples of how free imports stimulate taxed exports.

A. B. Anderson.

Hollinwood, *January 12th*, 1910.

Protection and the Electrical Industry.

Nowhere are the fallacies of free trade or free imports more readily seen than in the electrical industry. In no class of manufacturing does repetition and standardisation play such an important part, and what did the late lamented Richard Cobden know of such details? How could he foresee, and there are no signs that he did, that providing a manufacturer were sure of his own market, he could put down the requisite plant to manufacture on a large economical scale, and thus be in a position to supply his goods in an unprotected country at a lower price than the home manufacturer, and yet make a profit?

Free Traders say that any import tax raises the price to the consumer, but quite overlook the fact that internal competition will keep the price down in most industries. They quite forget, when convenient, the law of supply and demand. Why, in protected Germany, the manufacturers had to form groups to stop the insane internal competition, and though this may have been good for the consumer, it emphatically was not for the country, as we will presently show. The Free Trader will say, "But if the price does not rise, what is the advantage to the manufacturer?" Well, suppose the tariff shuts out half the foreign goods hitherto imported, the revenue will receive the import tax on this quantity. The home manufacturer will have a larger output than before, and thus be able to manufacture more cheaply without even raising his price, and I will show that he can well afford to raise his workmen's wages by the amount of the duty.

First, let me state that the Free Trader's maxim is correct, that a country should not attempt to produce that which by its resources it is unfitted to do in *fair* competition with its rivals. I would consequently also propose to limit all tariffs to 10 per cent. (with a clause as in the Canada Customs laws to prevent dumping), or a tax of 20 per cent. on the value of the LABOUR in the imported article, and we will show that the consumer is well able to pay the whole extra cost if all this should fall upon him. That this is not always the case was shown in the export tax on coal, which was paid by the foreigner, and the price of our greatest necessity was thereby reduced for our home industries. The encouragement of the export of coal appears to be about as sensible as would be the exportation of irreplaceable works of art, and this trade is quite dissimilar to any other, the depletion of our coal supply and its ever-increasing cost of working being a growing national and annual loss.

I have said I will prove that the consumer can afford to pay the increased price.

Let us assume a manufacturer, electrical, as it corresponds with the state of this industry, is doing a turnover of £500,000 and making no profit, and we will hope no loss, and that the foreigner imports £500,000 also. We now impose a duty of 10 per cent., and we will assume that this keeps out the foreigner altogether so that there is no revenue. Let us also assume that the manufacturer is producing goods to the value of £500,000, spent 60 per cent. on labour, and 40 per cent. on material and other expenses, thus making no profit. The turnover being now doubled and the market assured, he will be able to reduce his labour charges by at least 10 per cent., and his material and other charges by 5 per cent. on £1,000,000. Therefore the manufacturer will make a profit of £150,000 without increasing his price, or if he increase his price 10 per cent., a profit of £250,000.

The country as a whole will have to pay 10 per cent. more for this product, or £100,000. The manufacturer can pay his workmen this extra percentage in wages and the balance in taxes, so that the country is no worse off, or there would still remain a profit to the manufacturer of £150,000. The figures above stated would be largely improved upon in most industries, and there is also another important gain to the country. This country is going to manufacture £500,000 more than before, and spend £300,000 more in wages. Now, despite the Free Traders' argument—or, rather, statement—that displaced labour always finds another market, part of these wages is a *profit* to the country. I state that there is a profit to the country on *all* earned and unsweated labour. I state that every penny a man earns above and beyond that necessary to keep him from want is a profit to the country and himself. This could easily amount to £60,000 on the extra wages earned. If these men had not this job, they might become unemployed and cost up to £150,000, or some would become unemployable, and in spite of the slackness of men and effort to spin out jobs, unemployment in this country is deplorable.

You will, therefore, see that the profit and loss account is as follows :—

	Profit.	Loss.
Increased wages	£100,000	£100,000
Profit to manufacturer ...	150,000	—
Profit to country on extra wages earned	60,000	—
Saving to country through absence of unemployed	100,000	Balance profit £310,000
	£410,000	£410,000

I think that this shows there is some margin to provide for the indirect losses which the Free Traders say will follow the introduction of Protection. They will state that the industry I have selected is a special one, and I would reply that the whole object of Protection is to protect labour; there is no good object in taxing articles on which the value of labour compared to the finished article is small, and in a very large number, practically all the highly skilled industries, increase in production will reduce the price of production. Let us beware of shallow arguments similar to those used by workmen at the beginning of last century when machinery first began to displace human labour on a large scale, for any machinery or organisation which tends to cheapen the cost of production in your own country is of benefit to the nation at large.

Prices will not necessarily rise, in spite of Protection. There is such a thing as competition, and the employer with a large and assured output will still be able to make a profit and pay higher wages even at the old price. But there would be no competition, say the Free Traders, and trusts would be formed to keep prices up. Doubtless this would be attempted in some industries, if a law were not introduced to deal with this, but pause—Who are our great industrial, practical and know-all Free Traders? The monopolists; those men who are connected with industries, the establishment of which demands enormous capital, and which can only be run commercially on a large scale. Small firms cannot compete with them, they have their agreements and fixed prices irrespective of cost of production, and there is no competition. Look at Brunner, Mond and kindred companies. Of course they are Free Traders.

And is the British workman a Free Trader?

J. S. Hecht.

Chingford, *January 14th*, 1910.

Wrongful Dismissal?

I should be pleased if you would be good enough to publish the following in your esteemed paper, as I should very much like to have the unbiased opinion of critics regarding my actions before making an effort to obtain vindication in the two instances cited :—

One evening, when on duty in charge of a Corporation tramway sub-station, I received instructions from some one ringing up on one of the street telephones to cut the power off ———— Street, which is one of the busiest sections in the city, it being added, by way of explanation, that "the wires were all coming down." The man gave no clue as to his identity at the time, though I found out afterwards that he was an inspector, and, as such, acting quite within his rights.

However, not considering the message sufficiently authoritative, I did not carry out the order; but, lest anything serious might be wrong, I had the tower wagon and linemen sent out at once. I ascertained afterwards that some guard-wire had come down and become alive, and was thus a source of considerable danger. Temporary repairs were effected without the necessity of switching off the current.

The second incident occurred, unluckily, two mornings later. About 1 a.m. one of the feeder circuit-breakers opened once very violently, and about half an hour afterwards it opened again. A little later, one of the mains department men called at the sub-station to say that he had accidentally put his pick into a cable at a point about a mile away. I had no assistant on duty with me, and, of course, I could not leave the sub-station myself. The breakdown squad had gone home for the night, and would not be out till 5 o'clock in the morning; but, if urgent need had arisen, they could have been awakened and called out by someone calling at their homes.

However, as the power was still on the feeder, I resolved to let it remain, if possible, till the squad came in. But about 4 a.m. the circuit-breaker again opened, and after replacing it three times in succession, I left it out, and sent with all despatch for someone to go out and clear the faulty cable. By the time this was carried out, however, one or two of the early morning cars had been held up.

Now, in view of these two incidents, following so closely on each other, I was instantly dismissed from the service, although it was the first time I had been found fault with for over two and a-half years! Was this a warrantable procedure? Or is it another of the many cases of a junior being made the victim (for someone has to suffer) to screen a senior official?

Corporation Victim.

Contractor or Manufacturer?

It is indeed refreshing to see the article entitled "Contractor or Manufacturer" appearing in your issue of the 7th inst. The writer of the said article evidently knows his subject, and is not afraid to describe things as they really are.

I am well in agreement with him when he states that the average contractor is neither technically, financially, nor in business capability, strong enough to efficiently take advantage of the possibilities of electrical development. As in the case of power load, which would not have been developed but for the efforts of the supply engineer and the manufacturer, so in the case of a host of electrical "other use than lighting" apparatus, practically nothing has been or will be done, unless the supply engineer himself takes the matter up and realises its possibilities, both from the point of view of selling apparatus and selling current. The contractor is too slow to realise the former, and does not care a fig about the latter.

The article touches on the ever-pressing grievance the contractors have against the supply authorities for selling apparatus to consumers, and states that the supply authority cannot really be blamed for doing so. Whether or no this is a correct statement matters not, I would point out that neither the writer of the article, the central station engineer, the contractor, nor the manufacturer, will be the judge of the matter. The public alone will decide, and where sales departments are already adopted by supply authorities the public is deciding in no uncertain manner.

For years the consumers have been imploring the supply engineer to do the whole of their electrical business and not simply a part, and now their supplications are becoming so insistent that the supply engineer is "willy nilly" forced to accede to them.

Declining lighting revenue can only be made up by increasing revenue derived from "other uses," and certain it is that the average contractor is not capable, or is too slack, to push the sale of "other use apparatus."

The article indicates, quite truly, that, in due course of time, it will undoubtedly be found that the small contractor will not be wanted; the large contractor will be wanted only for private plants and large wiring installations, and the supply authority will do practically all the consumers' other electrical business direct.

This forecast is considerably strengthened by reference to the history of gas supply, which has gone through exactly the same trouble as electric supply is now experiencing, and found salvation by supplying not only gas, but all apparatus that consumes gas, on cash, hire and hire-purchase terms. They have not found the contractor of use in this connection.

H. H. Holmes,
Sales Manager.

Borough of St. Marylebone Electric Supply,
January 11th, 1910.

PROCEEDINGS OF INSTITUTIONS.

The Influence of Various Cooling Media upon the Rise in Temperature of Soft Iron Stampings.

By R. D. GIFFORD, M.Sc., Student.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *Birmingham, January 5th*, 1910.)

THE temperature rise of electrical machinery is one of the most important of the many considerations to which the designer has to pay attention, since the resistance of the copper conductors increases as their temperature rises, thereby affecting the regulation of the machine, and also because of the danger of damaging the insulation if the temperature rises above certain limits.

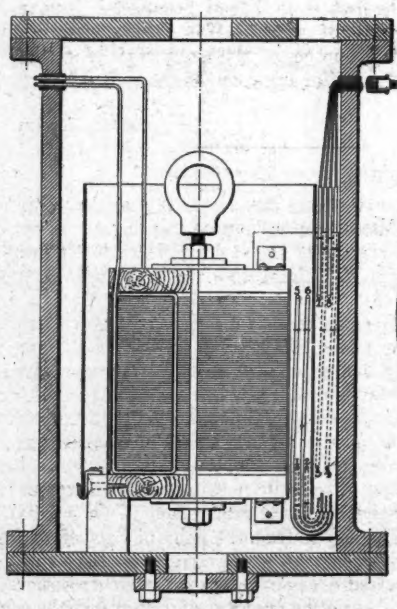


FIG. 1.—SECTION OF EXPERIMENTAL APPARATUS.

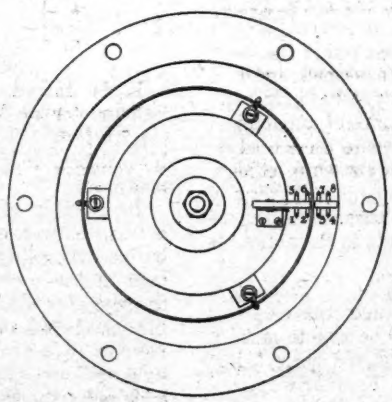


FIG. 2.—PLAN.

The heating of the iron stampings of transformers subjected to an alternating flux is due to the hysteresis and eddy-current losses. The latter may be greatly diminished by various methods.

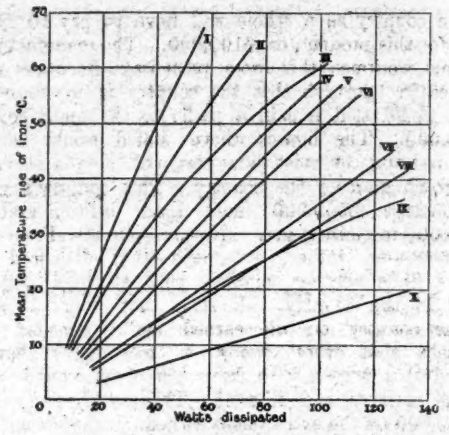
But apart from the choice of iron used, thickness of plates, induction, &c., the temperature rise is obviously greatly affected by the external conditions, such as the amount of exposed surface of iron and the medium in contact with the surface.

The flow of heat will depend upon the resistance offered to it, and also upon the temperature difference existing between the iron and the substance in contact with it. In fact, we have—

$$\text{Heat flow per sq. cm.} = \frac{\text{temperature difference}}{\text{resistance}}.$$

The resistance or its reciprocal, the conductivity, is made up of three distinct factors—viz., conduction, convection, and radiation—and the last two are not constant quantities, but depend upon the nature of the substance, as in the case of electrical resistances.

If the law governing the variation of resistance under various practical conditions can be determined, then the temperature rise of the apparatus is found if we also know the heat flow—that is, the energy dissipated as heat.



Curve I, air-cooled in case, with separating sheet; curve II, air-cooled in case, without sheet; curve III, air-cooled free in air; curve IV, first air blast; curve V, second air blast; curve VI, third air blast; curve VII, oil-cooling; curve VIII, more oil; curve IX, oil-cooling with separating sheet; curve X, oil-cooling with water worm.

FIG. 3.—COMPARISON OF THE VARIOUS METHODS OF COOLING.

The object of the research, then, was to determine the conductivity to heat flow existing between the surface of a cylinder made up of soft iron stampings and such cooling media as air and oil under the following conditions:—

1. Air, when the iron was (*a*) free in air, (*b*) enclosed in an iron case.
2. In a case, with draught of air flowing over the surface of the iron.
3. With iron surrounded by oil.
4. Iron in oil, and with cold water circulating through a cooling worm immersed in the oil.

The apparatus (figs. 1 and 2) consisted of about 300 soft iron disks, each 0·51 mm. thick, 16·8 cm. in diameter, and having 32 holes, each 0·5 cm. diameter, punched near the circumference, and a central hole 4·4 cm. diameter. These disks were clamped tightly together, forming a cylinder 16 cm. in height. The whole was then wound in gramme-ring fashion—that is to say, up an outer hole and down the centre—double cotton-covered copper wire, 1·41 mm. diameter, being used. At the top and bottom of the cylinder, on the circumference, fibre washers were placed, to insulate as far as possible the flow of heat longitudinally, and also to protect the winding from damage by the wooden end disks. The two free ends of the winding were brought out at the top through the disk, and the whole bolted firmly together. The case in which the tests with air blast and oil-cooling were conducted was made of cast-iron of circular section, having top and bottom plates bolted to the flanges.

The energy absorbed by hysteresis and eddy-current losses in the iron was measured by the three-voltmeter method. Only one instrument was used for measuring the three voltages and the current; this was a Duddell thermo-ammeter. The measurement of the temperature rise of the iron and cooling medium was effected by means of thermo-couples, of copper and Eureka; three of these were placed in the iron between the stampings, about ½ in. from the surface, near the bottom, middle and top respectively.

The formula found for the temperature rise of iron stampings exposed freely to the air, in terms of the watts dissipated per cm.² (σ) and the temperature rise (τ °C.), was—

$$\tau = 65\,(\sqrt{1 + 25\,\sigma} - 1).$$

When the stampings were enclosed in the iron case, the temperature of the air at the top and bottom of the iron was measured with eight thermo-couples, equally spaced between the iron and the case. The temperature rise in the iron showed a large increase, as compared with the previous case; and the formula obtained was—

$$\tau = 100\,(\sqrt{1 + 20\,\sigma} - 1).$$

When a separating sheet was inserted as shown in figs. 1 and 2, to aid convection by separating the upward from the downward current of air, the temperature rise increased, contrary to anticipation.

Cooling by air-blast was also tested, and the results show about twice as much power dissipated for the same final temperature rise, roughly speaking, the blast varying from 950 to 1,700 cb. ft. per hour.

Oil cooling, being more effective than air-cooling, enables a

smaller transformer to be used for the same output, and is therefore more economical. Its high specific heat is also a great advantage, in addition to its high dielectric strength. The transformer oil used had a specific gravity of 0·84 and a specific heat of 0·5 calories/gramme-degree. The case was filled to a height of 11 cm. above the upper wooden disk, fig. 1, about 3½ gallons of oil being used. In this instance the temperature rise is proportional to the power wasted, and—

$$T = 268\ \sigma.$$

The final mean temperature rise of the outer case is about two-fifths that of the iron core.

With the separating sheet in place practically the same results were obtained.

A coil of lead piping, 28 ft. long and $\frac{1}{16}$ in. in diameter outside, through which water was circulated, was then submerged in the oil; this was found to be exceedingly effective in cooling the iron, about 90 per cent. of the power dissipated being carried off by the water. This method should therefore be adopted for large transformers. Even if the water supply fails for a time, the enormous thermal capacity of the oil and the water in the coil prevents any large rise in temperature for a considerable period. There should be no joints in the piping inside the case, as the slightest trace of moisture in the oil greatly reduces its dielectric strength. Unassisted oil cooling is much more effective than air cooling, and where an air-blast is used, if the blast fails the temperature of the transformer quickly rises to a dangerous degree. Natural cooling in air is suitable only for small transformers.

Fig. 3 shows the comparative efficiencies of the various methods experimented upon.

The thermal conductivity of the various media was found in each case, and is given in the following table; if c be the conductivity, w the total power dissipated in watts, T the rise in temperature of the iron over the surrounding air in degrees C., and s the total exposed surface of the iron in cm.², then $w/s = cT$, or $T = w/(sc)$.

Condition of Cooling.	*Coefficient of Conductivity.*
Iron free in air	$1{\cdot}3 \times 10^{-3}$ to 2×10^{-3} for temperature rises of 20° to 60° C.
Iron enclosed in case ...	$1{\cdot}125 \times 10^{-3}$ to $1{\cdot}35 \times 10^{-3}$ for rises of 20° to 60° C.
Iron cooled by air blast	$1{\cdot}9 \times 10^{-3}$ to $2{\cdot}4 \times 10^{-3}$ depending upon volume of blast.
Oil Cooling.	
Iron to oil	$9{\cdot}4 \times 10^{-3}$
Oil to case	$4{\cdot}5 \times 10^{-3}$
Case to air	$1{\cdot}7 \times 10^{-3}$
Oil to water through metal piping.	$4{\cdot}5 \times 10^{-3}$

A 2,750-Volt Direct-Current System.

By A. H. BARRINGER.

(*Abstract of paper read before the* CANADIAN SOCIETY OF CIVIL ENGINEERS, *December 9th*, 1909.)

TWICKENHAM is chiefly a residential district, and, except for a few sawmills and the like, and the National Physical Laboratory, there are no power users. It is so scattered that there has been constant trouble in keeping the low-tension network balanced and up to standard pressure. The area supplied at present is about 25 square miles, but the company have powers which will eventually treble that total.

The low-tension mains, comprising about 60 miles of complete three-wire, are all linked up into one network, fed at suitable points by rotary transformers, and, of course, largely from the central. The generating station is situated in about the centre of Twickenham, about 2 miles from one end of the district now operated, and between 6 and 7 miles from the other. The transmission is by direct current at 2,750 volts, with future intentions of making it three-wire at 5,500 volts.

The present H.T. equipment consists of two 200-KW. 2,750-volt generators and one 100-KW. 2,500 : 500-volt rotary transformer, with booster attached for raising the low-tension side for transforming up, so that whilst during the day one H.T. set is run, supplying the two principal sub-stations and the home rotary transformer, during heavy loads the home rotary transformer is taking current from the L.T. board and transforming up. This has saved installing another generating set.

The generators are four-pole, direct coupled, running at 475 R.P.M. They are shunt-wound, with shunt separately excited, at 500 volts. These machines have now been running for about five years, and it is a curious fact that, although they have continually been in trouble from flashing over and other causes, the armatures have never had even a new former. For two years each machine was running without a break for 18 hours on each alternate day.

The switchboard consists of nine panels of iron throughout, with mica washers and bushings. The circuit-breakers are D.P. air break, and are ranged along the top, with a slate division between each set. The generator switches are fitted with maximum and minimum cut-outs, the minimum coil being fed from the 500-volt shunt circuits. The feeder cut-outs are simple overload. Five of the feeder panels are fitted with line regulating resistances, L.T. long-range operating switch, and paralleling voltmeters for running the automatic sub-stations. Each feeder is fitted with a surge arrester consisting of a series of spark gaps in series with an oil tank resistance. These arresters were installed after one of the lines had been twice broken down on charging.

The rotary transformers are two-pole machines of overtype design, with double-wound armatures running in a single field, and have copper brushes. They run at 500 R.P.M., and have a fixed ratio of 5 to 1. The regulating is done by resistance in the high-tension circuit. They are started up as series motors, and for this purpose are fitted with a small series field, which works in conjunction with a short-circuiting switch. The actuating solenoids of this switch are connected in series with the shunt-field circuit, which in its turn is connected straight across the L.T. end of the transformer. These switches are so adjusted that, when the L.T. pressure equals about 450 volts, the series field is cut out. The transformer bearings have small oil pumps working off a cam on the shaft ends, as well as the usual oil rings. These oil pumps have proved an expensive luxury.

There are at present four sub-stations, and these form what is perhaps the most interesting part of the system. One of them, the Teddington, is a manual equipped with two 100-KW. transformers, H.T. and L.T. switchboards, and a 1,000-ampere-hour battery. Each of the automatic stations is equipped with a transformer of 50 or 100 KW., a set of balancers worked by a time-switch, and a distance operated single-pole L.T. circuit-breaker. The only H.T. apparatus is the short-circuiter and a pair of switch fuses for isolating purposes. The Molesey station differs in that it has a 600-ampere-hour battery and a small L.T. switchboard, but it is so arranged that it is worked automatically with the battery floating. A man cycles out every morning to put the battery on charge, and again in the afternoon to take it off. The other stations are visited only about two or three times a week.

The regulation of these stations is done from the central by means of the line resistance, and for starting up, &c., a five-core ·008 armoured pilot cable is run back from each. It will be seen from the diagram that the actuating solenoid of the L.T. auto is connected from the opposite pole of the transformer and through to the "firing switch" at the central. From the firing switch another line is run back to the transformer side of the auto; were it on the other side, the switch could be operated whether the machine was

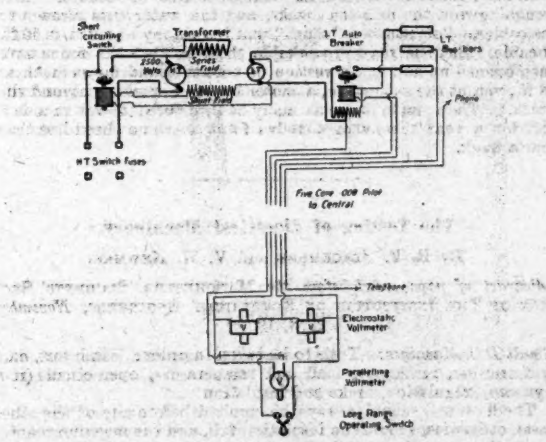


DIAGRAM OF CONNECTIONS, CENTRAL TO SUB-STATION.

running or not. As it is, when the machine is shut down there is no potential across the firing switch. This line also serves for the paralleling voltmeter, whilst for the other side of this meter another line is taken from the bus-bar side of the auto. Across these lines the electrostatic pilot voltmeters are connected, the fourth line in the cable serving for their neutral and the fifth for the telephone.

Taking the sub-stations first, the most frequent cause of trouble has been the H.T. brushes. These, as has been explained before, are copper, and when the commutator gets rough they have to be soaked with oil to prevent them wearing down between visits. Sometimes, too, they slip. Except for burning up the brush-holders, this never does any actual damage. So far as actual damage is concerned, the oil pumps and the L.T. autos have been the worst offenders. The weakness in the oil pumps is a sight-glass fitted on the pipe leading into the bearing cap. These glasses occasionally crack, the oil is pumped out on to the floor, and central is probably notified by the breakers coming out through the shaft seizing. Coming to the switches, it is necessary first to give a description of their action. The solenoid plunger operates the switch through a ratchet and pawl arrangement. When thrown in, the switch is held by contact friction, the exciting current is broken, and the plunger falls back to its original position. Next time the solenoid is excited the switch is pulled out, and so on alternately. The pawl springs are only light spirals, and often break. When this happens the switch is only thrown into the carbon ends, and the switch burns out.

The short-circuiting switches are designed to fall out by gravity when the machine is shut down, but occasionally they will stick up, and then the machine cannot be started until someone is sent down to pull it out. On starting up sometimes, if the pressure is higher than usual, or the starting resistance is cut out too quickly, the inductive effect set up by the series field is so considerable that a surge is started in the shunt, and the short-circuiting switch is thrown violently in and out 20 or 30 times before the machine begins to revolve.

There are six transformers installed, and whilst being subjected to all manner of strain through short circuits, &c., they have never been known to flash over. The chief trouble found with them is in the armatures and series coils. The latter, unless kept scrupulously free from copper dust, are liable to break down to earth.

One transformer in particular has an unfortunate penchant for discharging across the field air gap. The armature has been twice burnt out, probably through this. The danger of losing the shunt field has been provided for by dispensing with lifting attachment on the L.T. brushes. In the case of the home transformer, on the first starting-up of the plant, a faulty connection in the shunt-field circuit was overlooked, and when the current was switched on the machine built up in speed until the binders burst.

Coming to the generators, when everything else is right, the commutation leaves nothing to be desired; but a transformer burning out, or a short-circuit on the mains, and sometimes even a big jump in the load, will cause the generators to flash over. Beyond burning off a belt or pitting the commutator, no harm is done to the machines.

Summing up, the most inefficient part of the system is in the method of regulation. When, as is nearly always the case, one station is taking a comparatively heavy load, then the H.T. pressure must be run 100 or 200 volts higher than would suffice for the other stations. Consequently, this energy has to be absorbed in the regulating rheostats, and entails a very serious loss. Apart from this, the transformer efficiencies are very high.

The mains are in all cases underground, and, except for the troubles before referred to, due to the surging, there was only one fault developed on the H.T. system in five years. The cables are ·5 two-conductor concentric, paper-insulated, with lead sheath and outer steel-wire armouring, and are drawn into earthenware conduits.

The L.T. mains are on the solid system. The cables are coated with vulcanised bitumen, and covered with thick braid. They are laid in wooden troughs, supported on wooden bridges, the troughs being filled solid with bitumen, and a layer of tiles put on top.

These mains have been an endless source of trouble. The troughing rots, the bitumen cracks, and the water gets through to the cables. Sometimes a "short" will burn away as much as 50 ft. of cable. But the most remarkable thing is that the mains have been opened up and not a vestige of copper found for as much as 18 ft., yet, at the same time, a motor has been working beyond the break. There have been as many as three breakdowns in a day, and for a year the average mains faults have not been less than four a week.

The Testing of Electrical Machinery.

By R. F. BLACKMORE and V. W. NEWMAN.

(*Abstract of paper read before the* MANCHESTER STUDENTS' SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, *November 23rd*, 1909.)

Small D.C. Machines:—Tests to be taken in order: Flash test, core and friction, resistance, load and temperature, open circuit (if a dynamo), regulation, brake and insulation.

The flash test should always be applied before any of the other tests, otherwise, should the insulation fail, and the machine require rewinding, practically all the above-mentioned tests have to be repeated. For normal voltages 2,000 volts alternating is the pressure generally used for the flash test, this conforming with Admiralty and Government specifications. The transformer used is so designed that when the insulation breaks down and the secondary becomes practically shorted, the secondary volts drop, and, therefore, there is no excessive rush of current. The most convenient way of telling whether the insulation is holding up, is to have a bank of lamps connected across the secondary; these glow until the insulation fails, when they, of course, grow dim, or go out entirely.

The core and friction test is always taken with the brushes on the neutral. To find this position:—Connect a moving-coil voltmeter across the brushes, supply about one-third or less of normal excitation to the fields, and note the deflection on the voltmeter at the instant of breaking the field circuit. Move the brushes until no deflection is obtained on switching off the field; the brushes are then on the neutral.

The machine should now be run light and the watts through the armature noted. This result gives the watts lost in core and friction loss for the particular speed at which the machine is running. If a core and friction loss curve be required it is advisable to commence taking readings at the highest speed and to work down. The machine then comes to a steady speed much more quickly, since the losses accelerate the changes in speed.

After these readings the brushes should be moved back (for a motor) until very slight sparking just commences; beyond this point the lead must not be changed to stop the sparking, if any, on load.

It may be noted that on shunt motors the light-load speed when cold is nearly always the same as the full-load speed when hot.

The readings taken on the neutral and not those taken on back lead should be noted for the core and friction loss. With back lead, the coils connected to the commutator segments under the brushes are brought into a field which induces heavy circulating currents in these short-circuited coils. The result is a considerable increase in the power required to drive when running light. When load comes on, the armature cross-ampere-turns neutralise the field referred to and the circulating currents disappear; consequently no extra power is then required on their account.

The resistance of all circuits must be taken. This may best be done by passing a known current through the part under test and measuring the drop in volts across the latter. All field coils should have the drop in volts across their terminals measured in order to detect any partial or dead short-circuits in the winding.

The machine will now be ready to run on load, and undoubtedly the best way to do this, generally speaking, is to "load back" or connect as in the well-known parallel Hopkinson test. The saving in cost of power when large numbers of machines are tested (approximately 80 per cent.) as compared with the dead-load test, the ease with which the load may be regulated, and the absence of water tanks or resistance frames, are more than sufficient reasons for adopting this method, even when two similar machines are not available. Of course, in the latter case, the efficiency cannot be calculated according to Hopkinson's formula, but with the core and friction and resistance test results, the value may be arrived at.

Where possible, it is advisable to connect the two machines as shown in fig. 1, for then the dangers of paralleling are avoided, and the machines simply run up to speed as motors. The load may then be gradually applied by shunt regulation.

Open-circuit characteristics will often have to be taken. It is usual to bring the field excitation up to twice the normal value on these tests. With machines of above 300 volts, it is generally convenient to connect the field coils temporarily in two groups parallel; then only normal voltage need be applied to the field circuit in order to get twice the normal ampere-turns. With the strong field, the armature volts may, at rated speed, be above the range of the voltmeter; in that case, run at a suitable lower speed and correct accordingly.

Speed regulation tests on motors present no difficulties whatever, even when running on the Hopkinson test. Compounding and regulation tests on generators should be taken on dead load wherever possible. To obtain the correct compounding curve when machines have to "load back" presents some difficulty; for all practical purposes, however, the compounding effect may be tested as follows:—Run up to full load and normal voltage (v_1), take readings, mark the shunt rheostat positions and shut down. Next run up to speed on "open circuit," adjust the shunt regulator to the position marked and take readings (v_2). Again run up to full speed and correct current, only on this occasion adjust the voltage until it is equal to $v_1 \pm (v_1 - v_2)$: + when $v_1 > v_2$. Mark the new positions for the shunt regulators, shut down, start up again on open circuit and take readings. The difference between the last pair of readings gives what is practically the compounding effect.

Three brakes will generally serve to test any machine of a type up to a maximum of 150 H.P., although it is somewhat unusual to take brake tests on motors over 60 H.P. To enable these three brakes and pulleys to fit the various machines three sets of bushes, bored to the shaft diameters, are required. When designing these brakes and brake drums a safe figure to work on is to allow 1 sq. ft. of friction surface for every 15 H.P.; of course, this assumes a hollow drum into which water is poured. Wooden brake blocks are inclined to "chatter" until the rubbing surfaces have become thoroughly charred; even then a little oil used to lubricate makes the running smoother. Should the arm of the weighing machine oscillate, this may often be stopped by putting a rubber pad between the brake lever and the weighing machine table.

Large D.C. Machines.—All the tests called for on small machines must be taken, if possible; but should there be no suitable machine for loading purposes, then the temperature rise due to copper losses can be obtained by running on short circuit.

Frequently the machine, especially if non-interpolar, will be found to spark too violently on dead short circuit; in this case, one can only connect resistance and correspondingly raise the voltage to maintain the full-load current until all the available driving power is being used. After the short-circuit test, run the machine on open circuit with excitation equivalent to that required to give the normal voltage when on full load; note the temperature rise after six hours' run. Before starting the short-circuit test, the compounding coils, if any, should be either disconnected, or reconnected so that half help and the remainder oppose the shunt field.

The special tests mentioned in technical literature to meet these cases are rarely, if ever, used in commercial testing. Generally speaking, the temperatures obtained as above are from 8 to 10 per cent. lower than those measured after an ordinary full-load run.

The instruments required for D.C. tests are voltmeters, ammeters, galvanometers, potentiometer and a Wheatstone bridge. Instruments for works testing should be accurate within 1·5 per cent. for ordinary tests, while for experimental work the instrument error should not exceed ·8 of 1 per cent. Meters have to stand rough usage, so they should be easy to adjust, be shielded from stray fields (this is most important) and have well-defined open scales.

Moving-coil instruments are the most suitable for D.C. testing; it is usual to fit a switch in the instrument coil circuit, and the contacts of these switches require careful watching, as, especially on ammeters, and on the low-reading ranges of voltmeters, any dirt or difference in contact pressure results in low readings. Voltmeter switches require very careful insulating, especially when mounted on slate, as with any absorbed moisture the resistance between the different studs is quite comparable with the resistance in the volt box. Most of the switches work better when the contacts are damped with paraffin.

Low capacity ammeter ranges may be provided with a shorting switch—*i.e.*, a S.P. knife switch opening against a spring. This is a small detail, but it saves its cost in meter repairs many times over.

All the instruments on a test bed should be calibrated once in two weeks, and the results entered in a book, together with notes as to repairs, &c. After calibration a dated O.K. ticket should be

attached to the meter case; on the ticket such remarks as 1 per cent. high, zero error + or − ½ division, may be written.

For calibrating D.C. instruments and wattmeters, a potentiometer is most convenient.

A.C. Machines.—The number of these which can be tested at the same time is limited by the different periodicities and voltages, which necessitate the use of one or more motor-generator sets, although variations from the 60, 50 and 25 frequencies are seldom met with.

Small Induction Motors.—Before running the machine the resistance per phase of stator and rotor, if a wound one, should be measured by passing direct current through them and taking volts drop. Machines are flashed between phases and to ground at about three times working voltage.

Magnetising and friction loss is found by running the motor light, and noting the watts, volts and amperes per phase and light-load speed; then subtracting the c^2r loss from the watts will give the above quantity. If the amperes in each phase are not equal, and the resistances per phase measured above are, then a wrong connection between coils is probable. When the machine has a short-circuited rotor and no auto-starter is available, the full volts can be switched straight on to the stator; but with a wound rotor, a water or other rotor starter is necessary. The machine should not start up, or if so, it should rotate slowly only (due to eddy currents in the core) as long as the rotor circuit is open; if it does so, and cannot be stopped by a small braking effect, a short must be looked for in the rotor circuit.

For the temperature run the machine is belted up to a D.C. generator of similar output; if it has a short-circuited rotor, and no auto-starter is available, it is run up from the D.C. side and A.C. volts switched on at correct speed; then by strengthening the generator field, full load can be obtained on the motor.

The slip on a short-circuited rotor can be obtained by putting an ordinary field coil on the bearing of the motor and connecting this across a middle-zero milli-voltmeter, when the percentage slip

$$= \frac{100 \times \text{oscillations per minute}}{\text{frequency in cycles per minute of supply}}$$

The slip on a wound rotor is measured by putting the milli-voltmeter across two of the slip rings and taking readings as above.

The power factor is obtained by dividing the watts by the product of amperes and volts; if the power factor be low, the clearances are probably too high, due to the rotor diameter being turned too small.

Large Induction Motors.—For large machines the tests are, where possible, similar to those for small ones; if not a load run is given at full volts, half-amperes, and temperature taken, followed by a run at half volts, full amperes. The slip at full load can then be calculated from the Heyland diagram.

With two similar motors a Hopkinson test can be applied in a similar way to that on D.C. machines; for when two induction motors are belted up with differentialized pulleys and their stators put on to the same supply, they start up as motors until the machine which runs the faster reaches synchronous speed and becomes a generator supplying energy to the other machine, which acts as a motor (a balance being *approximately* obtained when the torques of the two machines are inversely proportional to their speeds).

Alternators.—As with induction motors, the ratio of flashing voltage to working voltage must be large, to allow for surges in the line. The polarity of the rotor must be tested by passing D.C. through the coils and running a compass round it; and the resistance per phase of the armature must also be measured. Where possible, the regulation test is made by running the machine at full load on water resistance, so that the current is in phase with the

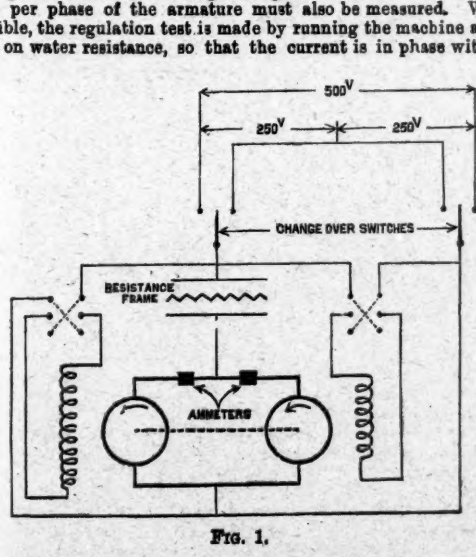


FIG. 1.

terminal voltage. When testing large machines it is usual to run a short-circuit and an open-circuit test. The former is made by short-circuiting the armature through a low-induction ammeter and slowly raising the field current till full-load current is reached in the armature; if several readings are taken between exciting and armature current and the results plotted, an approximately straight line, which is the armature short-circuit curve, is obtained. If now an open-circuit curve between field current and armature volts is taken, the regulation at full load can be calculated.

The temperature test is made by running the machine on full load when small, but with large machines this test is carried out by running on open circuit for several hours with the field current required to give normal volts at full load.

Synchronous Motors.—The tests on these machines are similar to those made on alternators. The machine is coupled up to a D.C. generator of equal output, and the set run up from the D.C. side; an open-circuit curve between volts and exciting current is taken at the synchonous speed of the motor. The motor is then synchronised with the A.C. supply, and the D.C. generator field increased to load up the motor. Curves are taken between exciting amperes and main amperes, keeping constant voltage and frequency on the motor, with unity power factor, the latter condition

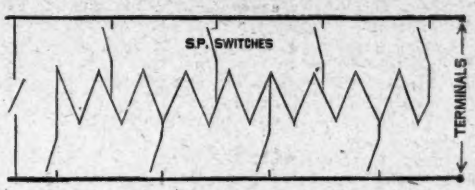


FIG. 2.

being obtained by adjusting the field current to give minimum armature amperes for the given load. The calculation of the efficiency is obtained in a similar way to that for alternators. The temperature test is made by a load run on the motor at catalogue rating. The motor can be started up light by running it up with the alternator which provides the supply.

Rotary Converters.—As with the above machines, the converter is flashed and its resistance taken. The light-load reading is taken by running as a motor from the D.C. side. The saturation curve is obtained by running the machine from an auxiliary motor and taking readings between field amperes and armature volts; the short-circuit curve is obtained in a similar way.

The efficiency can be obtained directly with small converters by running on full load with unity power factor and measuring input and output.

To test the synchronising conditions of the converter, the machine is run up to speed with a starting motor, the slip-rings and the three-phase supply being across a bank of synchronising lamps. At the moment of synchronising, shown by dark lamps, the field current and D.C. and A.C. voltages are noted; these data serve as a guide to synchronising the converter. The temperature test on a small converter is obtained by giving it a time run on full load; and with large machines by running on open circuit with field current greater than normal value, as on large alternators.

For works testing, resistance frames arranged on the lines shown in fig. 2 are suitable.

There are 10 or 12 resistance units of iron wire 8 to 10 S.W.G. wound on iron tubes, but separated from them by a layer of asbestos cloth, and connected in series with each other.

On a slate base attached to the iron frame holding the units are mounted two bus-bars, and as many S.P. knife switches as there are units. On closing the end switches all the units are in series. Closing all the switches puts all the units in parallel. Obviously almost any resistance between all in series and all in parallel may be obtained. Frames 6 ft. × 4 ft. × 5 ft. will absorb about 150 KW.

Rheostats are best made from manganin wire wound in spirals and mounted in expanded metal frames. This arrangement is in every way preferable to finer wires embedded in cement.

A C.D. of 1,000 to 2,000 amperes per sq. in. is about the average working for manganin resistances.

Water loads are occasionally required. A small pond about 20 ft. × 10 ft. × 5 ft. is most convenient for loading on, but generally a tank will have to be used. For good working it is necessary for the power to be absorbed in the liquid itself and not at the contact surfaces of liquid and metal—*i.e.*, regulation is obtained by varying the distance between the plates and not by varying the plate area immersed.

For low voltages, *i.e.*, up to 1,000 volts, a tank 4 ft. × 4 ft. × 3 ft. will absorb 500 to 1,000 KW., the maximum load depending upon the number of plates in parallel. For high voltages a tank of smaller cross-section and greater length, say, 2 sq. ft. area × 10 ft. long, is suitable for voltages up to 6,000 or 7,000. Baffle plates made of wood may be used to increase the apparent resistance between electrodes, but it is not advisable to cause the current stream lines to crowd too closely to the sides. This specially applies to metal tanks.

The following results have been obtained in practice with satisfactory working:—

Maximum C.D. on metal electrodes: ¾ ampere per sq. in. Water with an average specific resistance, when raised through 180° F., will decrease in resistance by about 50 per cent. The maximum safe drop in volts per foot of liquid is 500.

For a low-voltage generator, testing iron strip is very convenient for loading on; a strip 1½ in. × ⅜ in. will carry 2,300 amperes continuously. This is at a C.D. of 2,050 amperes per sq. in. If water-cooled (*i.e.*, submerged) the density may be run up to 15,000 amperes per sq. in. When using strip for load, a plug resistance frame for the fine regulation should be connected in parallel.

Successful Electrical Territorials.—At the recent prize distribution of the No. 1 Heavy Battery, Devon (T) R.G.A., the three Territorials employed at the Lynmouth Electricity Works carried off three firsts, one second and three thirds.

E

LEGAL.

Gravesend Electric Tramways, Ltd., v. Mayor and Corporation of Gravesend.

This action, in which was involved an important point respecting the measurement of energy for tramway purposes, was opened in the King's Bench division on the 13th inst., before Mr. Justice Hamilton. The Gravesend Tramway Co. brought an action against the Gravesend Corporation, who are the electric lighting authority, and supply electric energy to work the tramline, asking for a mandatory injunction ordering the Corporation to remove the electric meters in use, for an injunction restraining them from continuing to use meters for the supply of electricity to the plaintiff company. There was also a claim for damages.

Mr. A. J. Walter, K.C., and Mr. E. Hill appeared for the plaintiffs, and Mr. W. R. Bousfield, K.C., with Mr. G. A. Scott for the defendants.

Mr. Walter, in opening, said that the plaintiffs were the owners of 6½ miles of electrically-driven tramways within the borough of Gravesend, and the Mayor and Corporation of the town were owners of the electrical plant supplying energy to the tramway company to work their line. The history of the case started on February 11th, 1902, with an agreement between the parties for the supply of electricity, and by that agreement it was arranged that the amount of energy supplied should be measured by meters supplied by, and being the property of, the Corporation, and fixed in the power station of the Corporation. They were to be connected with a pilot wire, or some other arrangement, so that the amount of energy might be measured at the point of delivery. There was a provision in the agreement that when one of the three meters used showed an advance of more than 3 per cent. on the mean reading of the other two, that meter should be removed and readjusted, and in the meantime the amount of energy supplied should be ascertained from the two meters left, and in the event of either of those going wrong, from the one which remained. In the early days of the line, prior to 1906, heavy cars were used, but they were found to be too expensive in working, and by that date some of them had been taken off, smaller cars being substituted. Until January, 1907, there was no separate traction generator. The meters which the Corporation put in the station were of the Thomson type, which was widely known as a motor-meter, in which there were inherent difficulties of obtaining accurate measurement, amongst them being the liability of the permanent magnet to be affected by outer magnetic fields. Another difficulty with that type of meter was that it had to measure in the case of the plaintiffs' line, a current of 300 amperes, and usually much less, whereas it was more accurate with a large measurement. There was a serious difficulty, too, in starting the motor, and the way in which it was done was by putting in additional windings so as to create a field just big enough to start the meter, but not to run it to register when the consumer was not having the power. They knew from the correspondence which had passed that the meters did rotate without the consumer having any supply. For some time before 1906 the company had introduced a regenerative car; but in May, 1906, that was taken off. In 1905 the average energy used during the whole year was 1·216 units per car-mile. In 1906, when they had taken off the expensive cars, the average for the whole year per car-mile had been reduced to 1·199 units. The beginning of the trouble was in 1907. In January of that year the traction generator for the purpose of generating current for the line only had been connected, and almost immediately after that they began to complain of the increase in the units per car-mile; the first complaint was when the average consumption appeared to have increased by 13 or 14 per cent. The meter had been tested on three separate occasions, and had been shown to average about 20 per cent. fast. The Corporation, however, absolutely declined either to change the meters or to make any allowance. Counsel proceeded to deal with a mass of correspondence on the subject to show that the Corporation had made an allowance in 1907, showing that they admitted the meters to be incorrect. The result of the test was to show that on March 21st, 1907, one of the meters was 8·55 fast, another was 12·15 fast.

Mr. Bousfield said that the meters were all adjusted and fitted with the latest improvements.

Mr. Walter said that the result was that the Corporation on October 20th, 1907, allowed a rebate of £75. About that time the company proposed that the supply be measured at the station, and a certain formula was adopted, by which an allowance was to be made for the loss. That was incorporated in a supplemental agreement. The reason of that was they were desirous of taking a feeder to the far end of the line. The feeders were altered with the consent of the Corporation, but a new system of measurement was wanted, and another arrangement, dated January, 1908, was entered into, in which were provisions for the regulation of the meters at the request of either party. No new meters were put in under the second agreement; but they altered the connection of the old meters. Notwithstanding the allowance made owing to the meters being wrong, the units per car-mile run were less than in 1906 because more of the heavy double cars were out of service. On April 10th they found that the consumption was going up heavily under the new arrangement, and a correspondence took place as to the cause. A test was made with an artificial load, and the result was that they found one meter accurate and two were reading slow.

Mr. Bousfield, in reply to the Judge, said that his case rested mely upon the agreement.

Mr. W. G. A. Bond, chairman of the plaintiff company, was the first witness called, and, in answer to Mr. Walter, he said that at the commencement of the working they had 20 cars, 10 of which were on single trucks and 10 on bogies. At the present time they had 18 cars, 16 of which were on single-truck cars. They had no longer any big bogie cars. The latter had been entirely out of service for the past two or three years. Some time in the spring of 1907 they had a dispute in respect of the surcharge and an allowance was made. In the spring of 1908 they had cause to complain again of the increase in the amount of the current. They had tests made in April, 1908, on a constant load, and it was found that one meter was right and two were slow. In consequence of that he caused a thorough examination of the whole tramway system to be made to discover the source of the loss of energy. Throughout the whole of the tramway line there was found nothing to account for the rise. An Aron meter was then put into the Queen Street station, and a record wes kept of the exact number of miles run by each car. The company was supplied by the Corporation week by week with the number of units used. As a result, a claim was made against the Corporation in respect of an overcharge of 40,000 units up to 1908. A reduction was made of £253 from the annual bill. A further test was made in February, 1909, and the company, as a consequence, required new meters to be put in, but the Corporation refused, and the present legal proceedings were the result. There was nothing to account for the abnormal rise in the amount of energy taken, and his inquiries led to the conclusion that the consumption had gone down.

Mr. Chas. A. Baker, principal electrical assistant in the engineers' department of the London County Council, produced a report made by him upon the meters, which were the subject of the action, and described how he had tested them. The report showed that the meters were over registering, one by 16·4 per cent., and another by 21·5 per cent., and the third by 18·1 per cent.

Mr. J. L. Creagh, assistant manager of the plaintiff company, said that at the beginning of 1908 the consumption of current per car-mile was brought to his notice, and he took steps to see if he could account for it. He could not, however, do so until the meter tests were taken.

Mr. Macdougal, electrical engineer, gave evidence as to the result of his inquiries as to the cause of the increase of the current consumption on the plaintiffs' system. There was nothing, he said, in the service or the way in which the cars were run to account for the increase, and he came to the conclusion that the meters were not registering accurately.

On Saturday, Mr. Macdougal was recalled for cross-examination.

Mr. Bousfield: If three new B.T.-H. meters were put in, do I understand you to say that you would not be satisfied?—No, I should not, because I think the design would not be suitable for registering this class of supply. The Aron meter, if once set right, would be the nearest perfect meter without readjustment, and when once tested by the Board of Trade it does not require further testing.

The Witness was further cross-examined upon a number of letters which had passed between the tramway company and the Corporation as to the manner in which the meters were acting, in relation to which he said that up to April 10th, 1908, it had not occurred to him that the B.T.-H. meter was incapable of correctly measuring a fluctuating current.

There are more B.T.-H. meters used at this time than any other type?—That may be so, because they were first in the field. The number of cars in service might make a difference in the amount per car-mile; but that was a matter which could be easily checked. In 1905-6 there were 12 cars in service, and the units then averaged from 1·1 to 1·2. In 1907 there were 11 cars only in service, and the units got up to 1·2. In 1907-8 only 10 cars were in service, and the units rose to 1·4. In 1908-9 only 9 cars were in service, the units rising to 1·49.

The track and car equipments becoming older tends from year to year to run up the units per car-mile?—Very slightly, if they are properly looked after; but it does not apply in this case.

In answer to his Lordship, the Witness said that the construction of the Aron meter gave it a better chance of recording accurately.

His Lordship said the witness had made the point in dispute clear. It was really that they wanted another type of meter; but was there anything in either of the agreements which obliged the Corporation to substitute a meter of a different type?

Mr. Walter said that clause 1 of the supplemental agreement provided that the Corporation should supply three wattmeters, and that those meters should be fixed at the power station and connected in a manner to be approved by the company so as to measure the amount of energy supplied. His contention was that they never had supplied a meter under the agreement which was either fixed so as to measure accurately, or that was capable of measuring accurately, and the company had never approved.

His Lordship said that from 1902 to 1907 it appeared that the meters had done their work perfectly.

Mr. Walter, then they went wrong. Supposing all the meters went up and did not vary one from the other. Supposing they all went up 25 per cent. owing to the lapse of time; they would no longer be meters capable of metering.

His Lordship said if there was an implied obligation to keep the meter in order, it was not an obligation to keep step with the progress of science and adopt a better instrument if it came out.

Mr. Walter said he did not suggest that. [He only suggested that the meter should be a meter which was capable of metering, and the Corporation meters were recording instruments which would not measure. The meter must measure the amount of energy actually supplied. It was a condition precedent to the right to

charge for current supplied that they should install proper meters which would measure accurately the amount of current supplied.

His Lordship: In the event of failure of the conditions, what is your remedy? Is it to take the current and not pay for it at all, or is it to claim damages?

Mr. Walter said that the only course open to them was to compel the Corporation to comply, and until they did comply, there was no liability on the company to pay. They did not want to take that course.

Mr. S. C. Hillman, foreman in charge of the testing department of the Aron Electricity Meter Co., gave evidence as to his company having made the 400-ampere meter used in the September tests, and the result of the tests which he supervised.

It was subsequently arranged that the further hearing of the case should stand adjourned until the 27th inst., with liberty to apply in the event of there being an open day in the commercial list before that date.

David Hills & Co., Ltd., *v.* E. P. Allam & Co.

In the City of London Court, on Friday, before Judge Rentoul, K.C., this case was heard, in which the plaintiffs, of 2, Bear Street, E.C., sued the defendants, of Golden Square, for £14, money paid for an electric motor with a warranty of its efficiency.

Mr. W. Allen, plaintiffs' counsel, stated that it had proved inefficient, and the plaintiffs' case was that the consideration had failed. The parties began negotiations for the motor in March of last year. Plaintiffs had a small motor on their premises which was not doing its work satisfactorily. Defendants told them it never would work well, and advised them to get another motor—a second-hand 5-h.p., which they recommended. They said they would let the plaintiffs have it for £14, and that they should pay £10 cash, £4 being allowed for the old motor, which they were to hand over. The transaction was completed, but the motor was never satisfactory. Defendants guaranteed it for two years. From July to November plaintiffs were entirely without the use of the motor; then, when it was again started, some of the fuses blew out and the whole thing broke down. It was found absolutely useless. Plaintiffs therefore claimed for the return of their £14; they were not claiming damages for loss of business resulting from the non-use of the motor, which they might have done.

Defendants said that they had been the plaintiffs' electrical engineers for some years, and the present was the first dispute which had arisen. They had never had an opportunity of examining the motor complained of. They did not think that there was ever anything seriously the matter with it; the rocker bars probably wanted adjusting. They obtained an order for a new motor from the plaintiffs in the place of the one now in dispute, but the plaintiffs would not take it.

Mr. David Hills, plaintiffs' managing director, said no such order was ever given. Defendants said they were willing to take back the motor in dispute and supply another in its place, or put it right under the guarantee.

At the Judge's suggestion, the parties compromised the matter, and judgment was entered by consent for the plaintiffs for £13, to include costs, defendants to take back the motor.

The Blackpool and Fleetwood Tramroad Co, *v.* Urban District Council of Bispham-with-Norbreck.

In the Divisional Court on Monday, the Lord Chief Justice and Justices Bucknill and Bray had before them an appeal by the Blackpool and Fleetwood Tramroad Co. against a decision of the Justices for the County of Lancaster acting for the division of Kirkham and sitting at Fleetwood. The matter which came up on a special case, stated by the justices, related to a summons enforcing a general district rate on the appellants of £447 8s. for 1908. The defence was overpayment of previous rates. It was admitted at the hearing of the case that the rate was duly laid, that payment had been refused; that in October, 1904, there was an appeal by the Tramroad Co. against the Urban District Council of Thornton, claiming to be rated as a railway, which appeal ultimately went to the House of Lords, and was decided on April 1st, 1909, in favour of the appellants being rated at one-fourth for the tramway portion. It was further admitted or proved that while the appeal was pending, the respondents laid other rates in 1905 and 1906, amounting to £1,056 18s. 8d., with which the appellants were rated in full for the tramroad portion, and not at one-fourth, amounting to £596 10s. 8d. In August, 1905, the respondents discussed the position of the appellants in respect of paying the full rate with the appeal to the Divisional Court then pending, and ultimately the respondents decided to refund any money overpaid by the company should the appellants be successful.

At the hearing before the Justices, the Council contended that the tramroad company could not set off as against the 1908 rate any sum overpaid on the 1905 and 1906 rates; that if the appellants had any right of action against the respondents for the amount alleged to be overdue on the 1905 and 1906 rates, their remedy was in another Court; that what the Justices had to adjudicate on was whether the rate of 1908 was duly levied on the appellants, and was payment refused; which facts were all admitted, and the Justices had no alternative but to make an order for payment. The respondents further said that they were not parties to the appeal of the Blackpool and Fleetwood Tramway Co. *v.* the Thornton Urban District Council, which was heard at Preston Quarter Sessions, and ultimately went to the House of Lords. On behalf of the appellants, it was submitted that relying on the respondents' decision and the letter sent by their clerk, they did not appeal against the 1905 and 1906 rates, but paid the amounts in full, believing that if the decision went in favour of the tramway being rated at one-fourth, the amount overpaid, £460 8s., would be refunded. The amount overpaid on the two rates was £13 more than the amount of rate now claimed by the respondents.

The Justices came to the decision that the rate claimed from the appellants was duly levied, that payment had been demanded, and that the sum was owing by the appellants to the respondents. Accordingly, they made an order for payment of the amount claimed, £447 8s., and £1 6s. 6d. costs, and directed that, in default of payment, the sum due be levied by distress and sale of the appellants' goods. The Justices were of opinion that the appellants were not entitled on the same proceedings to set off the amounts alleged to have been overpaid by the appellants to the respondents on the 1905 and 1906 rates, as against the sum of £447 8s., owing to the general district rate dated June 4th, 1908.

Mr. Ryde appeared for the appellant company, and Mr. Gordon Hewart for the respondent Council.

At the conclusion of the arguments, the Lord Chief Justice said that, in his opinion, the overpaid money was unquestionably to be refunded if the appeal to the House of Lords succeeded. It seemed impossible that an order should be made for the full amount of the rate for 1908 when the overpaid amount for the previous years was in the respondents' hands to the credit of the appellants. He had difficulty in understanding why the magistrates did not take that matter into consideration. The order of the magistrates would be set aside and the appeal allowed, with costs.

Justices Bucknill and Bray concurred, and judgment was given accordingly.

Damages against the Electrobus Co.

In the King's Bench Division, on Thursday, January 13th, before Mr. Justice Phillimore and a common jury, Mrs. Evelina Anderson brought an action to recover damages for personal injuries received in August, 1908, as a result of being knocked down at Kilburn by one of the London Electrobus Co.'s vehicles. Plaintiff was cycling at the time with her husband, and it was alleged that the defendants' 'bus knocked her over and ran over her, fracturing one of her legs below the knee.

The defendants were not present in Court, nor were they represented. In their defence, however, they admitted plaintiff's injuries, but said they were caused by her own negligence, or at all events by her contributory negligence in not getting out of the way of the 'bus.

The Jury did not accept this, and returned a verdict for the plaintiff, assessing the damages at £375.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Portable Vacuum Cleaner.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., are placing on the market an electrical vacuum cleaner which should attract attention if only because it is really portable, weighing only 7-10 lb. and being comparable to the ordinary carpet sweeper in use.

Fig. 1.—Portable Vacuum Cleaner.

Reference to our view (fig. 1) will show that it consists of a small vertical spindle fan with a motor mounted directly above it, giving a very compact arrangement. The fan is provided with the usual wide suction nozzle, and discharges into a bag, supported at one end by the handle.

Lightness has been obtained by using aluminium wherever possible, and to facilitate the moving of the cleaner about the floor, the handle is attached through an adjustable swivel joint.

A length of flexible and a plug for attaching to lampholder or wall socket are provided; the cleaner shown to us required only ½ amp. at 200 volts, and is made for several pressures, either D.C. or A.C. circuits, while to meet the case of reduced pressures where the latter is used, Messrs. Drake & Gorham provide a suitable step-up transformer in connection with the plug.

Safety Device for Motor-Cars.

The device here described is intended for use on motor-cars, and consists of an electrically interlocked switch, the switch being designed to take the place of the ordinary switch used in conjunction with the magneto or coil ignition, as the case may be. The object of the device is to prevent a motor-car engine from

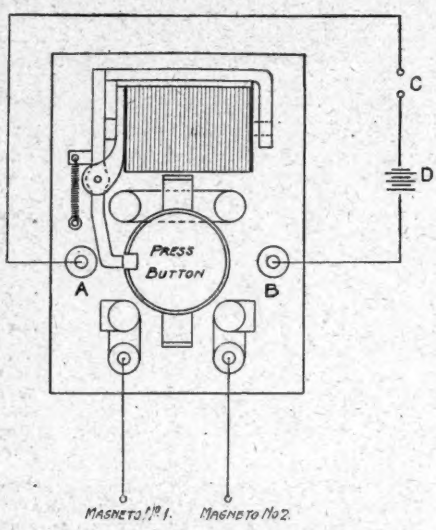


FIG. 2.—DIAGRAM OF CONNECTIONS.

being started when the change-speed lever is in any position other than the neutral; in any position but this, of course, the engine would be in gear, provided the driver had left his seat.

The accompanying diagram shows that there is an auxiliary circuit quite distinct from the ignition circuit, bringing a small coil, auxiliary battery D, contacts on the change-speed lever C, and other contacts on the switch A, B in series. Contact is made between A and B by depressing the button; the circuit is broken automatically when the switch is turned, thus preventing the circuit from being permanently closed when the change-speed lever is in the neutral position.

When the ignition switch has been turned to the "off" position, the locking device comes into operation and prevents the switch from being turned on until the armature has been actuated and has set the switch free; this can only be done when the change-speed lever is in the neutral position. In any other position the circuit would be broken and the switch remain locked. It will be noticed that the ignition circuit is in no way interrupted or interfered with by this arrangement. Accidents have occurred by the car being left in gear, and in one of these, which happened recently, the driver was killed by the car running over him immediately he turned the handle and started the engine. With the arrangement described above this would not be possible. The device is the invention of MR. B. N. DADGE, of Bradford.

Leonard Spring Holder.

The accompanying illustration shows a new spring for carrying lampholders on battens, introduced by MESSRS. W. LEONARD & CO., 4, Soho Street, Oxford Street, W. The device explains itself. The

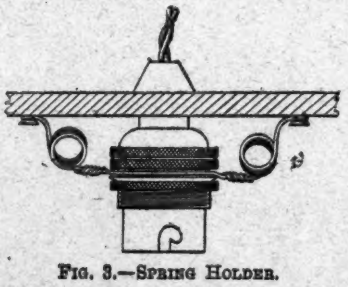


FIG. 3.—SPRING HOLDER.

makers anticipate that it will materially increase the life of metallic-filament lamps, and state that they have found it very effective on long battens for theatre lighting; it also suits their reflector sign, recently described in these columns, very well.

Reyrolle Wall-Plug and Socket.

MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne, have introduced a wall-plug and socket designed to meet the new Home Office regulations, which require the use of an earth wire in the flexibles of portable lamps in factories. As the illustration shows, provision is made for securing the earth wire to the socket, and a screw is provided on the plug to which the third wire of the three-wire flexible must be secured. It is essential to obtain thoroughly good contact between the plug and socket, as the earthing device

FIG. 4.—EARTH-CONNECTION WALL-PLUG.

on the plug would be absolutely useless without this, and in the 5-ampere size this object is attained by means of two phosphor-bronze springs, which scrape the inside of the cover every time this is pulled off or put on. In the larger sizes an extra pin is provided for making the earth connection between plug and socket.

No porcelain or cocus-wood is used in the construction of these plugs, the interiors being made of a specially hard and strong moulded material, which will stand severe heating and arcing, and the covers being of stout drawn brass. The terminals have been made specially large, and, although the plug is rated for 5 amperes only, a No. 9 wire can be got into any of the terminals.

Electric Lock for the Doors of Railway Coaches.

An electric locking device has been patented by MR. W. A. A. MITCHELL, of 67A, Camp Street, Broughton, Manchester, for the operation of which no personal attention is required, the mechanism being actuated by the opening and closing of any of the doors of the guard's van. The current required for locking and unlocking is only made use of momentarily; as soon as the doors are either locked or unlocked, the current is automatically switched off, and the whole apparatus re-set for operation in the reverse direction.

The apparatus consists of a door switch in each door of the guard's van; one set of locking mechanism in each coach; a special type of electrical coupling for connecting the wires between successive carriages; and a simple wiring scheme.

The door switch consists of a switch-lever which rests on one contact when the door is closed, but on opening the door, the lever moves on to another contact, thus completing the unlocking circuit, and the doors are unlocked. When the door is closed again, the lever returns to the first contact, and completes the locking circuit.

The locking device is a combination of solenoidal mechanism with an automatic change-over switch.

The solenoidal mechanism consists of a ⊥-shaped lever operated by means of two solenoids with plungers. When the locking circuit is completed by the guard's door switch, one of the solenoids is energised, and rocks the ⊥-shaped lever to one side. This motion slides a rod on each side of the coach, and causes the doors to be locked, by means of bolts, or other suitable means, carried on the rods. The unlocking is performed similarly by the mechanism acting in the reverse direction.

The electrical coupling is so constructed that it is impossible to connect the wires wrongly between successive carriages. Three main wires run throughout the length of the train: two positive wires and a common return.

The electricity is supplied from storage batteries placed in the guard's van, or other suitable source.

Lantern Slides.—MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne, state that they have a large number of lantern slides illustrating their various manufactures, many of which are of interest to engineers connected with mines, power installations, central-station work, &c., and they will be glad to send sets on loan for use in connection with lectures at colleges, engineering society meetings, &c.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

Part III.

The following known methods of loading a telephone loop have been mentioned :—

(*a*) *Coil Loading*, consisting of the insertion of inductance coils at regular intervals in the circuit ;

(*b*) *Continuous Loading*, consisting of the provision of one or more coatings of iron wire, or other magnetic material, upon each wire of the loop.

Coil loading will be first considered, but, before proceeding to state the practical results obtained and the method of determining the improvement due to loading, it may be desirable to describe briefly the coils used and the method of including them in cable circuits.

In the first instance, before the development of the present-day magnetic-core loading coil, experiments were made with inductances containing no iron or any other magnetic material. The most recent form of such a loading

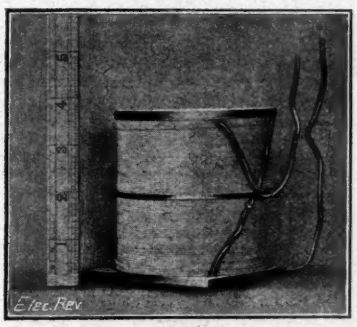


Fig. 8.

coil is illustrated by fig. 8. It consists of a bobbin of insulating material, such as ambroin, divided into two equal parts by a diaphragm. Two similar coils of silk-covered copper wire are wound, one upon each side of the diaphragm. There will, of course, be four ends to each loading coil, but only two are clearly visible in the illustration. The general dimensions may be taken by reference to the inch scale to the left of the figure. Four of these bobbins are then placed in a box of teak or other hard wood, so that the axes of three of the coils are at right-angles to each other ; the fourth coil being placed with its axis nearly parallel with

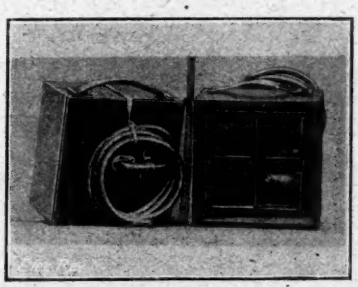


Fig. 9.

that of the one diagonally situated with respect to it in the containing box, and the whole are adjusted until no inductive effect takes place between any one and the others. The box is then filled with compound and placed in a second hard-wood case, the space between the boxes being filled carefully with petroleum jelly. The coil ends are jointed to, and led out of the case by means of, a silk and cotton-insulated copper wire, lead-covered cable ; the whole presenting the appearance shown by fig. 9.

* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

By the courtesy of the Western Electric Co., Ltd., an illustration of a modern magnetic-core loading coil is given in fig. 10, from which the general dimensions may be estimated. The core is a ring, approximately circular in

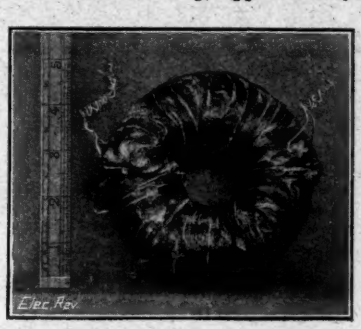


Fig. 10.

cross-section, made up of finely drawn wire of some magnetic material, the exact description of which cannot be given. Upon this ring two similar coils of insulated copper wire are wound, and the whole is steeped in highly insulating wax. Any desired number of such coils are then placed in a strong, cast-iron, air-tight case similar to those shown in fig. 11 ; the coil ends being connected to, and brought out of the case by means of, india-rubber and cotton-covered lead-sheathed cable.

The above-mentioned cases of coils are only used on underground cables. At the points along the route of the cable at which it has been decided to insert coils in the

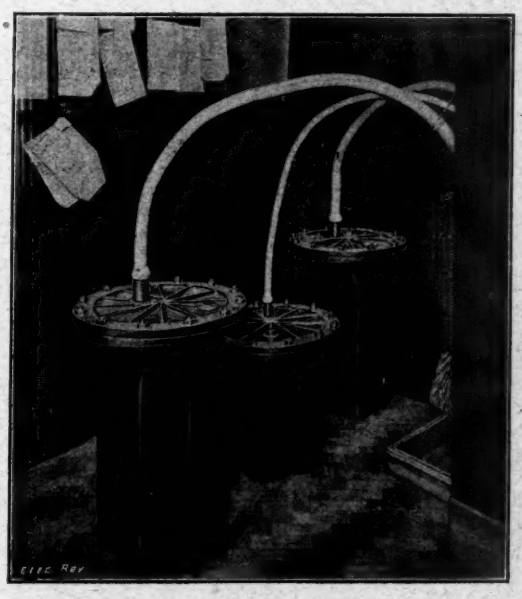


Fig. 11.

circuits, a brick-built pit such as a joint box, chamber, or manhole, is provided and the cases of coils are stored therein. The method of connecting the coils to the main cable is the same for both air-core coils in wooden cases and iron core coils in iron cases. Within the pit or manhole is fixed a cable distribution head (fig. 12), which consists of a cast-iron box and ribbed lid capable of being made air-tight when combined. The main cable from one direction is led into the box or head at A and the cable from the other direction at B ; while the lead-covered cable from the coil case enters the head at any point in either side—say C, fig. 12. The cables at A and B are connected together through the coils, the ends of which are contained in cable C. If more than one case of coils be necessary for the loading of the cable, additional coil-ends may be led into the box at such positions as D, E and F.

In describing the method of arranging air-core coils in wooden cases, it was mentioned that they were specially

arranged so as to eliminate inductance among themselves. Every air-core coil has an external electromagnetic field; consequently there are the following disadvantages:—(*a*) If the coils be placed near any mass of metal, eddy currents are set up in the latter, which, by reaction on the coil, increase its *effective* resistance and lower its efficiency; (*b*) If a case of air-core coils be placed near a mass of iron, the electromagnetic fields of the coils are distorted; the conditions under which they were arranged in the case so as to be free from inductive disturbance, one upon another, do not hold, and overhearing occurs between all of them. (*c*)

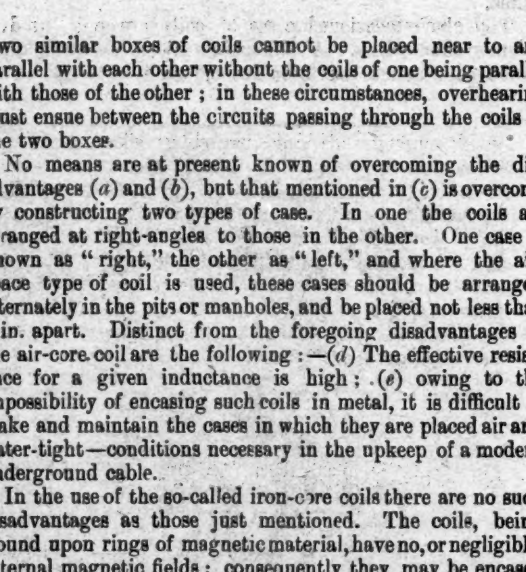


Fig. 12.

Two similar boxes of coils cannot be placed near to and parallel with each other without the coils of one being parallel with those of the other; in these circumstances, overhearing must ensue between the circuits passing through the coils in the two boxes.

No means are at present known of overcoming the disadvantages (*a*) and (*b*), but that mentioned in (*c*) is overcome by constructing two types of case. In one the coils are arranged at right-angles to those in the other. One case is known as "right," the other as "left," and where the air-space type of coil is used, these cases should be arranged alternately in the pits or manholes, and be placed not less than 4 in. apart. Distinct from the foregoing disadvantages of the air-core coil are the following:—(*d*) The effective resistance for a given inductance is high; (*e*) owing to the impossibility of encasing such coils in metal, it is difficult to make and maintain the cases in which they are placed air and water-tight—conditions necessary in the upkeep of a modern underground cable.

In the use of the so-called iron-core coils there are no such disadvantages as those just mentioned. The coils, being wound upon rings of magnetic material, have no, or negligible, external magnetic fields; consequently they may be encased in metal, and, provided a thin iron shielding plate be placed between them as a precaution against electrostatic or slight electromagnetic effect, may be placed one upon another to any extent without being subject to inductive interference between themselves or from other sources. Moreover, since metal may be employed, the cases may be made air and water tight and durable. One of the most important points, however, is that properly designed so-called iron-core coils possess a much higher inductance than air-core coils for a given effective resistance.

Although the expression "iron-core coil" will be used in future, it will be understood that the core may not consist of *pure* iron. Such coils have one disadvantage—namely, that if a current of abnormal strength from a telephone point of view—say, 0·15 ampere—be passed through the circuit for testing or other purposes, the cores of the coils are liable to become permanently magnetised, in which case the inductance of the coils is lowered, and the effective resistance increased; a result naturally followed by a decrease in the efficiency of the circuit. This, however, is not a serious matter, since any suspected permanent magnetisation of the cores of the loading coils may be readily removed by one or two applications of the following treatment:—Apply a relatively strong alternating voltage to the circuit so as to cause a current of 0·2 virtual ampere to pass through it. Then, by inserting resistance in the loop, gradually reduce the current strength to less than 0·001 ampere.

In view of the foregoing facts, there is little doubt but that the coil with a continuous and closed core of some magnetic material will be the loading coil of the future.

(*To be continued.*)

BUSINESS NOTES.

Consular Notes. — British India. — The Belgian Legation at Calcutta reports that the United Kingdom holds about 90 per cent. of the trade in electrical instruments and apparatus in India. The principal importers of electrical goods in Calcutta are:—F. Osler & Co., Ltd., 12, Old Court House Street; Walter Locke & Co., Ltd., 4, Esplanade Row East (London agents, Lancelott Dent & Co., 118, Cannon Street); Balmer Laurie & Co., 103, Clive Street (London agents, Alex. Laurie & Co.); Burn & Co., Ltd., 7, Hastings Street (London office, 7, East India Avenue, E.C.); Octavius Steel & Co., 14, Old Court House Street (London agents, Octavius Steel & Co., 5, Fenchurch Street, E.C.). British India produces certain raw materials for the electrical industry—*e.g.*, mica, gum lac, manganese and rubber. Mica is found chiefly in Bengal and Madras, and according to an official census there are 45 mines with 15,723 employés. The firms holding these mines are:—F. F. Christien & Co. (London agents, Brown Shipley & Co., Founder's Court, Lothbury, and Bakers and Starter, 19, St. Dunstan's Hill, E.C.); The Dickson Irwin Mica Mining Syndicate (London office, 27, Austin Friars); India Mica Mines (London agents, Micanite and Insulators Co., Ltd., London, E.C.), Eugenie Constance Mica Mines and Mining Co. (London agents, Rothersgat Indigo and Trading Co., Putney Hill). The exportation of mica in 1907-8 amounted to 38,922 cwt., valued at Rs. 3,422,420, as against 26,392 cwt., valued at Rs. 1,902,505 in 1908-9. The gum lac used as an insulating material in the electrical industry, is a very important article of exportation from India. The amounts exported in 1906-7, 1907-8 and 1908-9 respectively were 254,088 cwt., 340,008 cwt. and 372,186 cwt., valued at Rs. 33,711,498, Rs. 38,770,887, and Rs. 27,358,350. The great proportion of the gum lac exported is sent to the United States. The chief producing provinces are Bengal, Eastern Bengal, Assam, Central Provinces and Berar. There are in Bengal and the United Provinces 62 lac works, employing 6,000 hands. The exports of manganese in 1908-9 amounted to 8 760,275 cwt., valued at Rs. 7,264,223, as against 10,968,392 cwt., valued at Rs. 8,589,404 in 1907-8, and the chief purchasing countries are Great Britain, France, Belgium, Holland and the United States. The exports of rubber from India are not very important, being in 1907-8 2,990 cwt., valued at Rs. 578,397, as against 1,964 cwt., valued at Rs 319,039 in 1908-9. The chief purchasing country is the United Kingdom. There is, says the report, a good opening in India for dynamos, motors, electric lighting apparatus, and electric ventilators of all kinds. The use of fans is becoming universal.

Brazil.—The Belgian Legation at Rio de Janeiro reports that the electrical materials most in demand in Brazil are copper wire and cables (bare), wire and cables insulated with rubber, &c., arc lamps and incandescent lamps for 120 volts alternating current of 50 periods, lighting apparatus exclusively electrical, or electrical and gas mixed; telephones and their accessories, batteries, electric bells and their accessories, electric generating groups (petroleum motors, gas motors, &c., coupled to dynamos), glassware for lamps, &c.; accumulators, carbons for batteries and lamps, insulators, porcelain tubes, interrupters, switches, &c. The telephones preferred are those of the Ericsson type. For ordinary articles (interrupters, insulators, lampholders, &c.) the type is American. Much difficulty is experienced in placing other types, not only on account of the price, but also because of the preference accorded to American houses by Americans resident in the country (and it must not be forgotten that the staff of the Rio de Janeiro Tramway, Light and Power Co. is American). It is impossible to give any exact idea of the prices owing to the keen competition in the market. As a consequence of this competition goods are often sold at prices less than those ruling in Europe. This is the case in incandescent lamps, on which there is a duty of 15 per cent. Carbons for batteries are sold at 450 reis. In order to do business it will be necessary to keep constantly in mind the scale of prices charged by American houses. It is said that these prices admit of considerable profit. In general the employment of commission agents is not possible. Manufacturers do a direct trade granting credits of from three to six months, according to the reliability of the customer. The chief companies dealing in electrical goods in Rio de Janeiro are:—The Cia. Brasileira de Electricidade (Siemens); Behrend, Schmidt & Co.; Haupt & Co.; Victor Uslaender & Co.; Guinle & Co.; Vasco Ortigao, 66, rua de General Camara; Trajano de Medeiros & Co.; Dodsworth & Co.; Walter Bross & Co. In the State of Rio Grande do Sul the electrical industry has seen little development. Since the installation of the works of the Cia. Force et Lux at Porto Alegre, however, a beginning has been made with the importation of small motors of 1½, 2 and 3 H.P., costing 500, 550 and 600 milreis respectively at Porto Alegre. The opening for apparatus for electrical work is, however, anticipated to be of considerable importance, several installations having been put in recently even in the small towns. At Porto Alegre the following three works supply electric light and power:—

The Cia. Fiat Lux, the Cia. Forca et Luz and the works of the municipality. At Rio Grande there is the Cia. de Illuminacao Electrica; at Bage, the Empreza de Luz Electrica (Emilio Guilayn & Co.); at Uruguayana, Barbara et Filhos. There are also electric lighting works at Santa Maria, Alegrete, Sao Gabriel, Santa Cruz and Santa Victoria de Palmar. The principal telephone companies are the Empreza Uniao Telephonica at Pelotas, the Cia. Telephonica Rio Grandense, at Porto Alegre, which exploits several State lines. Besides these, there are several telephone systems in the various towns. There is only one electric tramway system in the State, that of 40 kiloms. length at Porto Alegre worked by the Cia. Forca et Luz. This company has just agreed to purchase the Anglo-South American Works Co. It is proposed to establish electric traction on the tramway system at Rio Grande, and the Cia. Illuminacao Luz Electrica will supply the necessary power. The works named import their supplies direct from Europe, or purchase on the market. The principal firm on the market, Bromberg & Co., represents a German house, and has branches at Porto Alegre, Rio Grande and Pelotas, for the sale of electrical goods. The house at Hamburg is that of J. Rech. The firm Thompson & Co., of Porto Alegre, also sell lamps and electric wires. In order to introduce their goods on the market manufacturers should address the above-named firms and works. Trade is hardly ever done through commission agents.

Arc Lamp Patent Dispute.—We are asked to state with reference to the notice of opposition against Mr. C. E. G. Gilbert's Patent No. 27,303 of 1908, by Mr. H. P. Bleckly, of the Abbey Electrical Co., that this opposition has now been withdrawn by the opposer.

Venner Signs.—We are informed that Venner Signs surmounted the cinematograph displays of the *Daily Chronicle* and *Daily Mail* at Croydon, Shepherd's Bush, Upper Street, Islington, Aldwych, Fleet Street, Clapham Road, Hop Poles Hotel, Hammersmith, &c., and that they also displayed the names of candidates in various parts of the country.

Calendars and Catalogues.—MESSRS. EVERSHED AND VIGNOLES, LTD., Acton Lane Works, Chiswick, W.—New Year souvenir in the form of a desk blotting pad with a convenient top diary and monthly calendar. At the left-hand side of the pad there is an abridged catalogue of electrical instruments. We think this is about as convenient a pad as we have seen.

MESSRS. JAMES SPENCER & Co., Chamber Ironworks, Hollinwood, near Manchester.—Wall calendar with sheets on each of which appears a clearly printed half-tone of one of the firm's drilling machines, lathes, or other machine tools, above a month's dates which are boldly shown. A little pocket across each of the bottom corners prevents the sheets from curling up.

MESSRS. ENGINEERING INSTRUMENTS, LTD., of Skerne Works, Darlington, have sent us a hanging calendar with neat monthly tear-off slips above which appears a design embodying reprints of a large number of catalogue pages showing the firm's manufactures.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., Aston, Birmingham.—Folding leaflet giving particulars and prices of the "E.O.A." metal-filament lamps.

MESSRS. W. LILEY & Co., 18, Renshaw Street, Liverpool.—A number of desk blotting slips on the upper side of which a calendar for 1910 appears.

MESSRS. A. SEAGE & Co., Cambridge Switch Works, Hammersmith, W.—Sheet No. 50 briefly describing and stating prices of their patent (type 11) D.P. fuse switches; sheet No. 49 shows type No. 38 D.P. knife switches for pressures up to 300 volts, in polished teak cases.

MESSRS. WARD & GOLDSTONE, Springfield Lane, Salford.—New 16-page catalogue of their small "Sherbourne" petrol-electric lighting plants, which in conjunction with metal-filament lamps are being much used for private installation purposes. They range from ½ H.P. (20-10 C.P. 25-volt lamps) and are, we understand, having a large sale in the Colonies and the East for lighting bungalows, yacht lighting, and other small purposes where only 12 16-C.P. or 20 10-C.P. lamps are required. Switchboards, accumulators, wires and cables and lamps, for use with these and other sets described, are also included—all the contents of the list being of English manufacture. The list has been prepared largely for the convenience of Colonial and foreign readers.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.—22-page catalogue giving latest particulars and prices of their electric radiators and heating and cooking appliances, including a number of designs. Two, three and four-light luminous radiators, a number of convector type with ruby lamp illumination, "Phœnix" hot water radiators, electric ovens, and ranges, irons, hot plates, and so forth, are well shown. A loose list gives particulars of the "Sun" electrically-operated locks.

We are again indebted to the BRUSH ELECTRICAL ENGINEERING CO., LTD., for a hanging calendar with a block of daily slips each containing a quotation from Shakespeare. Above these slips appears an art illustration in colour showing a Brush alternator on the bearing of which a little cherub sits in more or less discomfort reading (is it a volume of the ELECTRICAL REVIEW or a Brush catalogue?) while an old owl looks over its shoulder. The Shakesperean quotations, as always, are interesting, and that for Monday last is particularly so to the electrical industry: "Lay aside life-harming heaviness, and entertain a cheerful disposition."

MESSRS. KOHLER BROS., 56, Ludgate Hill, E.C.—Sixteen-page publication relating to the multiple push-button automatic speed control for printing press operation. A lengthy list of newspaper and other establishments in different parts of the world where the system is in vogue, is given.

MESSRS. CONNOLLY BROS., LTD., Blackley, Manchester.—Second edition of their 32-page pamphlet giving exhaustive particulars regarding their patent enamel insulation, and price lists prepared according to both English and metric standards.

THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, W.C.—Thirty-two-page catalogue issued by their "Lamp Department." It contains particulars of a number of new electrical illuminating devices that are supplied by the firm. "Aegma" metal filament, carbon filament, and Nernst lamps are shown and priced, also radiator lamps and radiators, the "Ideal" candle fitting, flexible strip and lamp chain for illuminating purposes. Reflector rosettes for sign forming are described, the advantage of which is that any letter or ensign can be made up from same, then dismounted and re-made, according to requirements. The company's name appears only on the fly-leaf, which, being perforated, can easily be removed by contractors and traders. A loose leaflet shows and prices the medical lamp.

THE ADNIL ELECTRIC CO., LTD., Adnil Building, Artillery Lane, E.C.—110-page catalogue (stiff covers) containing in well-arranged style and with numerous illustrations, particulars of a large variety of "Adnil" telephone and signalling apparatus. It is difficult to single out from such a multitude of lines any particular articles for full reference here, but the ground covered may be indicated by stating that there are shown domestic telephones, battery, wall and table telephones, magneto wall and railway telephones, loud speaking telephones with hooter call, central battery telephones, gas and water-tight magneto, telephones for mines, &c., portable and inter-communication sets, switchboards, electric hooters, and fire alarms, loud sounding bells, signalling instruments for mines and railway yards, "Alpha" self-winding electric clocks, lightning arresters, and so on.

MESSRS. ARC LAMPS, LTD., Sphere Engineering Works, St. Albans, Herts.—24-page list just issued containing description, illustrations, diagrams and prices, of the Davy "Sunrae" flame and enclosed arc lamps. Conditions of working, trimming instructions, and prices of accessories, are included.

MESSRS. DAVIDSON & Co., LTD., Sirocco Engineering Works, Belfast.—New publication (No. 1,006) of 48 pages, entitled "Dust Removal," in which the application of "Sirocco" fans in engineering works, textile mills, paper mills and other works is discussed, and a number of interesting half-tone views are given, showing such works with these fans in use.

The New French Tariff.—A correspondent of a German newspaper, in suggesting that that country should adopt reprisals against the French tariff that is now coming before the Senate, states that the new duties will specially affect the imports of electrical apparatus into France. Measuring instruments, which were originally admitted duty free, were removed to a fresh number in the treaty of commerce with Switzerland and subjected to a duty of £1 12s. per cwt.; but in the new tariff they have been placed under a new number and a duty of 500 fr. per 100 kg., or £10 per cwt. At the beginning of the deliberations in the French Chamber, the idea of levying in principle a duty of about 10 per cent. of the value, was said to be in contemplation; but £10 per cwt. exceeds such a measure, as even among the cheaper apparatus there are some which come into serious consideration, and are consequently subject to an excessive burden. The cheaper voltmeters, for instance, have a net sale price of 25s. 6d., and weigh up to 2 kg., thus involving a duty of 8s., or about 30 per cent. A Ferraris instrument costs £4 17s. net and weighs 5 kg., the duty being £1, or over 20 per cent. In conclusion, the correspondent remarks that the price of a small measuring transformer is £3 14s., and it weighs 24½ kg., whereas the import duty is £4 18s., or 132 per cent. of the value.

British Cable-Makers' Success in China.—A contract for supplying and erecting about 183 miles of electric wires and cables for lighting the Imperial City of Nanking, China, has been secured by MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., of Blomfield Street, London, E.C. We understand that the negotiations extended over a very considerable period, and the competition on behalf of numerous German and other foreign firms was very keen. The ELECTRICAL REVIEW is pleased to congratulate Messrs. Henley's upon having emerged successfully after such international competition, though really it is little more than we should expect from a firm which has always been so enterprising. To a certain extent this success is a triumph for British enterprise, and is a very welcome answer to the pessimist, showing that the complaint of want of energy by no means applies to all of our British manufacturers. We hope it is but a foretaste of many similar good things to be soon obtained in the Far East. We are confident that greater enterprise will bring greater triumphs all round.

Private Meetings.—FELGATE & STOREY, electrical engineers, Queen Victoria Street, Reading.—Messrs. Corfield and Cripwell report that a meeting of the creditors of the above was held on the 12th inst. The statement of affairs presented showed liabilities to the extent of £2,464. The indebtedness to the trade was £1,169, and there were unsecured cash claims of £1,095. The estate thus showed a deficiency of £1,433. It was reported that the business was founded about seven years ago by Mr. Felgate. At that time he had a capital of £230, which was borrowed from the bank. Subsequently money was borrowed from a Mrs. Notley, the partly secured creditor, and the loan obtained from the bank was repaid. The securities held by Mrs. Notley consisted of three life policies of the surrender value of £45. The unsecured cash creditors were friends and relatives of the debtors. The amount actually advanced was £940, the balance being in respect of interest. It appeared that no interest had ever been paid on the loans. Mr.

Storey joined the business in December, 1906, and a deed of partnership was entered into. Mr. Storey brought in £500 as his share of the capital. About this time a branch business was opened at Oxford. During the first year the branch made a profit, but later some losses were incurred. At first the Oxford branch was conducted by a manager, but subsequently Mr. Felgate superintended this business himself. The fully secured creditor was Mr. H. Storey, who advanced a sum of £250 in 1908, and as security was given an assignment of the book debts of the Oxford business. The face value of the book debts was about £400. Notice of the assignment had been given to the debtors, and it was stated that the assignment was quite in order. The debtors had each drawn about £3 a week from the business. With regard to the turnover, this had been about £3,000 per annum at Reading, and £900 yearly at Oxford. It was estimated that a gross profit of 20 per cent. was made. The rent of the two shops was £160 per annum, and £20 was paid away weekly in wages. Creditors had recently taken proceedings against the debtors. One creditor for over £80 was in a position to put in an execution, but had withdrawn pending the result of the present meeting. On behalf of the debtors, an offer was made of a composition of 10s. in the £, payable in three months. If the offer was accepted, the cash creditors would withdraw their claims until the composition was paid. The debtors were unable to offer any other security. After a short discussion, the debtors' offer was accepted, subject to the cash claims being withdrawn, and to the secured creditor surrendering his assignment of the book debts. As further security, it was decided that a deed of assignment should be executed to Mr. G. E. Corfield, of Messrs. Corfield & Cripwell, Finsbury Pavement, E.C. (representing trade creditors), and Mr. P. B. Allnott, of Reading (representing the cash creditors). A committee of three of the principal creditors was also appointed.

Change of Address.—THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION has removed to Caxton House, Westminster, S.W.

Book Notices.—*Local Government Annual and Official Directory*, 1910. Edited by S. Edgecumbe Rogers. 1s. 6d.—This is the 19th year of publication of this useful directory, which is issued from the offices of the *Local Government Journal*. There are many of our readers connected with various branches of the electrical industry who want to know the names of members of London Corporations, the L.C.C., the Port of London Authority and other public authorities. They will find this information in this book, together with particulars as to population, rateable values, and capital invested in electrical and other undertakings. An abstract of the Local Government legislation of 1909 is also included.

L'Année Electrique, Electrothérapique et Radiographique. By Dr. Foveau de Courmelles. Paris: Ch. Béranger. 1910. Price 3 fr. 50.—Dr. Courmelles's review embraces so large a scope, that he finds abundance of material to write about. The bulk of the work, as usual, is devoted to the two subjects last named, but there are numerous interesting items of information relating to all manner of electrical devices and systems brought forward during the past year.

Journal of the Institution of Electrical Engineers. Vol. 43, No. 198. December, 1909. London: E. & F. N. Spon. Price 5s.—This number, which ends the volume and is accompanied by the index, contains papers on "Economics of Medium-Sized Power Stations" (A. J. J. Pfeiffer); "Some Tests and Uses of Condensers" (W. M. Mordey); "Some Considerations in the Manipulation of Dry-Core Telephone Cables" (F. G. C. Baldwin); "Electricity Works and Refuse Destructors" (J. A. Robertson); and a number of original communications, the report and accounts for 1908, &c.

Referring to the review of Mr. Steinmetz's new book on "Radiation, Light and Illumination," in our issue of January 7th, the HILL PUBLISHING CO., LTD., point out that their London address is 6, Bouverie Street, Fleet Street, E.C., where the book may be obtained.

We have been favoured with a copy of the *Engineering Diary* for January. It is a penny monthly for the jacket pocket, and contains tables and curves and other matter "for convenient reference and subsequent filing." This matter is in the form of tables and curves, which are taken almost entirely from the technical Press. Such other contents as there are, besides a number of pages of squared paper for daily memoranda during the month, consist chiefly of advertisements of the business of a big electrical manufacturing company at Trafford Park. It is distinctly amusing to find the editor discrediting the value of the contents of his own publication by admitting that "mistakes may creep in owing to the data contained in papers read before societies, &c., being incorrectly reported in the technical Press," and, further, "the Editor does not accept responsibility for the accuracy of the data published." Well, after that, why—!

"Science Abstracts." Vol. XII, part 12. Sections A and B. London: E. & F. N. Spon. 1909. Price 1s. 6d. each section.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIII, part 5. Milan: Rebeschini di Turati e C.

"Journal of the American Society of Mechanical Engineers." January, 1910. New York: The Society.

The Electrical Employers' Association of New South Wales.—We are pleased to learn that this Association, which was formed in Sydney, New South Wales, last year, is being heartily supported by the electrical trade in that quarter. Under the guidance of its first president, Mr. E. J. Erskine, it has already done good work in the interests of its members. The first work which it fell to the lot of the Association to undertake was that of contesting a Wages Log issued by the Electrical Trades Union of New South Wales. As usual, this claim of the employés' union contained some very arbitrary conditions which, if not opposed by the employers, would have proved very detrimental to the progress of the electrical industry in the State. As the result, however, of evidence brought before it by this Association, there is every reason to expect that the Industrial Court, in the award which it is about to make, will establish working conditions more acceptable to employers generally. At the last meeting of the Association, held on November 30th, it was decided to approach the Commonwealth Government with a view to obtaining longer times in which to prepare tenders for electrical material required by the Commonwealth telephone and telegraph services, as under existing conditions tenders frequently close so quickly, that it is not possible for contractors to communicate with the home manufacturers for quotations. The Association is also endeavouring to obtain improved electric light and power legislation for the State, in order to facilitate the establishment of electric supply undertakings in the various country centres.

The following are the officers of the Association:—President, Mr. E. J. Erskine; Vice-Presidents, Messrs. W. A. Goeche and A. J. Hanson; Treasurer, Mr. H. W. Ramsay Sharp; Executive, Messrs. A. Waddell, H. R. Forbes Mackay, F. Bell, J. E. Donoghue and A. W. Kendall; Secretary, Mr. R. Burgin.

Trade Announcements.—With reference to the notice appearing in our issue of January 7th, the IMPERIAL LIGHTING Co. inform us that their stock has now been replenished after the fire, and the plant and machinery is running as usual. They are able to execute orders without delay.

For family reasons, the business of MESSRS. D. GILSON & CO., of Kingsland Road, N.E., makers of screws, terminals, &c., has been converted into a limited liability company, under the style of D. Gilson & Co., Ltd. All the assets and liabilities of the old firm of D. Gilson & Co. have been taken over by the new company, and there will be no change whatever in the management.

MESSRS. STEGMANN & CO. have opened a new showroom at Clapham Junction for the display of electric light fittings, heating apparatus, &c, including a selection of the latest designs in fittings and glassware.

MESSRS. D. H. BONNELLA & SON, LTD., of Mortimer Street, W., now have an additional telephone number; their numbers are Gerrard 1,882 and 9,784.

MESSRS. WALTERS & CO., engineering agents and power and lighting experts, of Ocean Chambers, Birmingham, now hold the sole agency in Birmingham and the Midland Counties for Messrs. Greenwood & Batley, Ltd., of Leeds, for the whole of their manufactures in dynamo-electric machinery and De Laval steam turbine plants. They also represent Messrs. Bergtheil & Young, Ltd., of London, for their patent "Bandy" single-phase repulsion motors, specially designed for lift and crane work.

Dissolutions and Liquidations.—THE TELAUTOGRAPH CO., LTD.—This company is winding up voluntarily, with Mr. F. A. Bagnall, 31, Budge Row, E.C., as liquidator.

HIMALAYA ELECTRIC RAILWAY, LTD.—This company resolved at meetings held at 28, Chapel Street, Liverpool, to wind up voluntarily. A meeting of creditors will be held on January 25th. Creditors must send particulars of their debts, &c., to Mr. W. W. Turner, 28, Chapel Street, Liverpool, the liquidator, by February 23rd.

YEOMAN & CO., electrical engineers, New Street, Bishopsgate Street, E.C.—Messrs. E. B. Boucher, J. R. Gardner, and W. Grisold have dissolved partnership. Mr. Boucher will attend to debts and continue the business.

HASTINGS, ROBERTS & CO., electrical and general engineers, contractors and agents, Barcelona, and 27, Queen Victoria Street, E.C.—Messrs. Harold Hastings and T. C. Roberts have dissolved partnership as from October 1st last. Mr. Hastings is attending to debts and continuing the business as the Peninsular Engineering Co.

UNITY MOTOR, ELECTRICAL AND GENERAL ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. J. G. Taylor, 28, Baldwin Street, Bristol, as liquidator. A meeting of creditors is to be held on January 25th.

LA CAPITAL TRAMWAYS CO., LTD., LA CAPITAL (EXTENSIONS) TRAMWAYS CO., LTD., LA CAPITAL TRACTION AND ELECTRIC CO. (BUENOS AYRES), AND THE BUENOS AYRES NEW TRAMWAYS CO., LTD.—Meetings of these companies are to held at 62, London Wall, E.C., on February 22nd, to hear an account of the winding-up from the liquidators (Messrs. E. A. Lazarus and F. Thursby).

Japan-British Exhibition.—We learn that quite a large number of the most eminent firms in the country have secured a considerable amount of space at this Exhibition. These include Platt Bros., Oldham, who have taken over 6,200 sq. ft.; Dobson & Barlow, of Bolton, 5,000 sq. ft.; Robert Hall, Ltd., Bury, 1,300 sq. ft.; Armstrong, Whitworth & Co., Ltd., over 2,000 sq. ft.; Vickers, Sons & Maxim, Ltd.; the L. & N.W. Railway, over 1,300 sq. ft.; the G.E. Railway, over 1,300 sq. ft. Among other well-known firms who have booked space are the following:—Chloride Electrical Storage Co., Ltd., Western Electric Co., Brunner, Mond & Co., the United Alkali Co.

Bankruptcy Proceedings.—PETER SMITH, electrician, Mill Street, Warrington.—First meeting, January 22nd, at Manchester; public examination February 4th, at Warrington.

R. E. WALKER, electrical engineer and cycle agent, Hereford.—Receiving order made January 12th, at Hereford Court.

J. PLATT and R. BLEASDALE (Platt & Bleasdale, electrical engineers, Bolton).—Receiving order made on debtor's petition on January 14th. First meeting, January 28th, at Manchester; public examination, February 2nd, at Bolton.

LIGHTING and POWER NOTES.

Acton.—The report of the assistant district auditor says that the gross revenue of the electricity undertaking for the last financial year amounted to £9,004 and the expenditure was £9,175, leaving a deficiency of £171. After providing for repayment of loans £2,377, and interest £2,390, there was a total deficiency of £4,943 for the year's working. A surcharge of four guineas was made in regard to payments for special services rendered by one of the Council's employés at the Electrical Exhibition.

Australia.—Extensive alterations have recently been carried out in the retort house at the South Melbourne works of the Metropolitan Gas Co. at a cost of £45,000. These include a small power plant with two 65-KW. Westinghouse-Crossley generating sets which supply energy for working various machines—coal crushers, elevators, charging machines, &c.

Bexhill.—On the recommendation of Mr. Hooper, L.G.B. Inspector, the Council has resolved to apply for the cancellation of sanction to a loan of £240 for meters, and to purchase the same in future out of revenue; also to withdraw its application for sanction to borrow £498 for the purpose of public lighting, and in future to defray expenditure for public lighting out of revenue. Acting also on the Inspector's suggestion, the Council resolved to raise an extra £700 to meet the anticipated expenditure on house services for the next two years. The remaining gas lamps in the streets are to be replaced with electric lamps.

Bovey Tracey (Devon).—The Newton Abbot R.D.C. has passed a resolution to the effect that no overhead wires will be allowed in any streets or roads at Bovey Tracey, and that the cables must be laid underground.

Brazil.—American Consular reports state that a new rate for private lighting is being instituted by the Light and Power Co. consequent on the completion of recent works—*i.e.*, 12 cents per KW.-hour instead of 21 cents as at present charged. For public lighting the new rates range, per KW.-hour, from 7·7 cents to 6·3 cents, between 5 million and 15 million KW. total consumption. A reduction of 20 per cent. is given to charitable and educational institutions, and the company has to pay the City $48,000 per annum for fiscalisation and inspection.

Bury St. Edmund's.—In order to popularise the use of electricity, the T.C. has decided to hire out small arc lamps for exterior shop lighting at a fixed quarterly charge of 2d. per unit, with a minimum charge of 30s. per annum.

Cape Colony.—Sea Point, the marine suburb of Cape Town, which has had public gas lighting for 21 years, has recently turned over to electricity. Under the old arrangement the Cape Town Gas Co. supplied 156 45-C.P. lamps for £1,100 per annum; the new arrangement costs £1,529 per annum, for which sum the Corporation supplies 50 flame arcs and 109 100-C.P. Osram lamps, allowing 2,240 burning hours per lamp per year. The new street lighting was switched on December 20th, and we understand is giving great satisfaction, it has, moreover, resulted in 40 additional private consumers being connected up.

Continental Notes.—HOLLAND.—The town of Leeuwarden has decided to build an electric generating station at a cost of £21,000; the Harmelen and Vleuten authorities are arranging a scheme of electricity supply in the communal districts in the south-west of the province of Utrecht; a central station would be erected at Harmelen.—*Board of Trade Journal.*

GERMANY.—An American contemporary states that a new plant is being installed in the region to the south-west of Oldenburg, and lies in the vicinity of extensive peat fields from which the fuel supply is to be secured. The electric plant is laid out on a large scale, and when completed it will be one of the largest in the country. It is to furnish energy over a network of power lines which will cover the entire Duchy of Oldenburg, within a radius of 40 miles. Probably the new station will be completed about the end of next year, and in the meantime measures are being taken to find out about what amount of energy will be taken.

ITALY.—An international exhibition of lighting apparatus of all kinds, and especially those suitable for marine purposes, is to be held in Genoa this year.

AUSTRIA.—Application has been made by the Director of the Etschwerke for leave to build a power station on the Schnalser beck. The power available is 15,000 H.P.

Coventry.—The Electric Light Committee of the City Council has decided to recommend that, subject to the sanction of the L.G.B. being obtained to the necessary loan, it shall be authorised to expend the sum of £39,200 on extensions of plant, £13,000 on cables and transformers, and £2,000 on motors, making a total of £54,200.

Dundee.—Mr. A. W. Paton, of the T.C. Electricity Committee, is very anxious to safeguard the Corporation against any further claims being brought for failure to supply power. Mr. Harry Richardson, the electricity engineer, assured him that the new power station at Carolina Port was now in good going order, and that no claims were likely to arise. Mr. Paton also desired an authoritative report showing the estimated and actual cost of the whole undertaking, the cause of the delay in getting the station in order, and where the fault, if any, lay. The Lord Provost, after discussion, ruled that Mr. Paton was not entitled to get an official to make up special reports for his information, and the matter then dropped. A formal opening is to take place in connection with the new electricity station, and a committee has been appointed to endeavour to secure the services of some distinguished man to perform the opening ceremony.

Fleetwood.—A L.G.B. inquiry was held on Friday into the application of the U.D.C. for a loan of £3,197 for electric supply purposes. There was no opposition.

Glasgow.—At a meeting of the Electricity Committee, the town clerk reported that the Corporation had adopted the following resolution:—"That all standing committees be instructed in making contracts to provide in all schedules and specifications for preference being given to goods of British manufacture," and stated that he proposed to give effect to the resolution by inserting in the form of tender attached to all schedules and specifications the following words:—"The Corporation reserve power to give a preference to goods of British manufacture."

It has been remitted to the electrical engineer to report as to the rates charged for lighting and power purposes in the city, and whether any reduction can be made.

Heywood.—The Electricity Committee has appointed Mr. J. R. Salter consulting engineer for the electricity and tramways undertakings at a fee of £50 per annum, to date from July 1st, 1909.

Houghton-le-Spring.—A return, presented to the local Guardians, of the cost of lighting the workhouse, shows that with the use of electricity, the expenditure has been considerably decreased.

London.—With regard to the rating of the L.C.C. tramway sub-stations at Lewisham and Forest Hill, the County Council claimed that the rateable value should be £317 and £310 respectively. After considerable negotiation with the Borough Council, the rateable values have been agreed at £608 and £465 respectively.

HAMPSTEAD.—At the meeting on January 13th, the B.C. decided to engage Sir Alexander Kennedy to report, at a fee of 400 guineas, on the future working of the electricity undertaking. The report is required in consequence of the probability of large additions to the plant at the generating station being required in the near future. A motion was passed that steps be taken to oppose before Parliament the three tramway schemes affecting the borough included in the L.C.C.'s Tramway and Improvements Bill for the coming Session.

Lowestoft.—The T.C. has applied for a loan of £1,500 for meters, £1,000 for public lighting, and £350 for air pumps for condensers. The L.G.B. has sanctioned a loan of £1,822 for a new 250-KW. set and mechanical stokers.

Maidenhead.—The T.C. has received from the L.G.B. sanction to a loan of £2,856 for a Diesel oil engine, and £595 for the extension of the buildings.

Monaghan.—At the meeting of the U.D.C. last week, Mr. H. V. Pegg appeared before the Council in connection with the proposed electric lighting of the town. Mr. Pegg submitted a statement in which he said that the installation would cost about £4,000. The further consideration of the matter was adjourned till the next meeting of the Council.

Morecambe.—In connection with a recent note referring to the refusal of the Corporation to supply energy to Messrs. T. W. Ward, who had made an offer to take energy at 1¼d. per unit on a guarantee of 1,000 units per week for a certain period, we are informed that the offer referred to periods of light load only, also that, of the proposed expenditure of £2,500, only £800 could be allocated to Messrs. Ward's proposal.

Rhodesia.—It is intended to equip electrically the Wankie Coal Mine, both on the surface as well as underground, for power and lighting purposes. The present boilers and engines will be utilised, but electrical generators are to be installed which will provide the necessary current. Cables will be laid all over the property and down into the workings. Endless rope haulage is to be used underground.—*Commercial Intelligence.*

Rhyl.—The U.D.C. has received from the L.G.B. sanction for a loan of £4,000 for electricity purposes.

Richmond-on-Thames.—The assessment of the Electric Supply Co.'s undertaking has been reduced from £3,893 to £1,633.

Rosyth (Fife).—Operations are being pushed forward rapidly with the installation at the new naval dockyard at Rosyth, on the Forth. The four National gas engines, each of 300 H.P., are almost ready for use. Thirty feeder cables already lead from the station to various parts of the site. As many as possible of the cranes, including all used for the heaviest work, will be electrically driven; and in all the shops—engineers' and blacksmiths', wagon fitters', saw mill, carpenters', &c.—the motive power is to be electricity.

Saltburn.—The Cleveland and Durham Power Co. has informed the U.D.C. that a supply of electricity could not be easily effected from the mains at the cost desired by the Council. The Council has decided to negotiate with the local company.

Stockton Heath.—The P.C. has appointed a Committee to formulate objections to the application of the Salt Union, Ltd., for a prov. order for electric lighting.

Tottenham.—Plans lodged by the North Metropolitan Electric Power Supply Co. for laying cables, also for a new sub-station in Hale Road, have been passed.

Ventnor.—The U.D.C. has accepted the tender of the Isle of Wight E.L. Co. for improved lighting at the pier pavilion.

Wakefield.—The T.C. has applied to the L.G.B. for a loan of £7,150 for electricity supply purposes.

Widnes.—Negotiations which have been proceeding between the Salt Union of Cheshire and the T.C. for the supply by the former of electricity within the borough have borne fruit, and the company's terms, which are locally regarded as advantageous, have been accepted by the Corporation. The Salt Union's position to supply exceptionally cheap electricity is held to be largely due to having its surplus steam from a chemical manufacturing process in new works to be erected at Weston Point. The terms submitted by the company and accepted by the Council, representing the maximum prices, are as follows:—Small consumers for lighting, such as houses and shops, 4d. per unit, with a maximum charge of 10s. per quarter; to small consumers, for power purposes only, 2d. per unit; to large consumers, primarily for power purposes, the maximum charge 1½d. per unit; the maximum price to be charged to the Corporation for traction purposes, up to 500,000 units per annum, 1d. per unit, and for all in excess of 500,000 units, ¾d. per unit.

U.S.A.—The Chicago City Council has been considering the lighting of all its streets by electricity, which will require some 29,000 arc lamps, towards which 13,000 are at present in use. The Sanitary Authority which supplies the present needs of the city has proposed as an alternative that it should purchase the city's plant and take over the lighting, as in this way the Lockport plant, which operates in connection with the drainage system, could be better loaded. For some time the Sanitary Authority has been trying to induce the city to equip its pumping stations for electrical operation.

Yarmouth.—The great utility of electricity for motive purposes has been illustrated at Yarmouth. The gas engine driving the machinery at a printing works broke down on January 11th, and within a very short time the electricity staff of the T.C. had connected up with the tramway cables a 9-H.P. motor. The gas engine repairs took several days to execute.

TRAMWAY and RAILWAY NOTES.

Australia.—A Bill has been introduced into the South Australian Legislative Assembly for the electrification of the Glenelg Railway at a cost of £115,000. The line has cost £162,000 up to the present.

The representatives of the Prahran, Malvern, St. Kilda and Caulfield Councils have agreed to the proposed tramway between Caulfield and St. Kilda (Vic.), and these latter Councils are to join the Prahran-Malvern Tramway Trust.

Canada.—Application is to be made to Parliament for permission to construct an electric railway about 50 miles long from Niagara Falls Town to Dunnville; the company is capitalised at £102,000.—*Board of Trade Journal.*

Continental Notes.—GERMANY.—The Berlin Municipal Traffic Committee has concluded the consideration of the draft contract between the city and the A.E.G., with regard to the proposed elevated and underground railway between Gesundbrunnen and Rixdorf. It is calculated that the expenditure on the railway would amount to £4,200,000, of which the city would advance up to one-half to the A.E.G. in instalments at 4 per cent. interest; repayment would be effected in instalments extending over the first 36 years of the proposed 90 years' concession. The railway will have a length of six miles, most of which will be underground.

The Erzgebirge-Vogtland Railway and Electricity Co. has just been formed at Chemnitz with the participation of the Zwickau Electricity Works and Tramway Co., which belongs to the Dresden "Elektra" Co. The object is to construct a railway from Aue *via* Schneeberg-Neustadtel to the industrial part of the Vogtland, and to supply light and power to the adjoining districts. Contracts for supply to three communes have already been concluded, and negotiations with others are in progress.

HOLLAND.—The Leyden authorities have decided to approve an application by the Noord-Zuid Hollandsche Co., for powers to construct and work an electric tramway in the centre of the town, connecting with suburban lines.—*Board of Trade Journal.*

Brazil.—The General Vehicle Co., of Long Island City, U.S.A., has recently shipped to the tramway company in Rio de Janeiro, Brazil, two electric motor tower wagons for use in connection with the maintenance of the overhead conductors. The chassis are of the company's standard 2-ton type, the power being obtained from a 44-cell storage battery which furnishes current to the motor at 85 volts. The vehicles have a speed of 12 miles an hour and a range of 40 miles on a single charge, while accommodation is provided for seven men in addition to the driver, as well as for tools and repair materials.

Fife.—The Fife C.C. has decided to oppose the provisional orders being promoted for the extension of the Wemyss and Dunfermline District Tramway systems. The chairman—Sir Ralph Anstruther, Bart., of Balcaskie—pointed out that it was not from any motives of hostility that this was being done, but merely to preserve their rights as a Council, and to prevent the public highways being interfered with. A resolution was also passed approving of the principle of tramways within the areas named in the orders.

Ecuador.—A Bill has been submitted to Congress providing for the construction of an electric railway, 106 miles long, between Quito and Ibarra. The cost per km. is fixed at £2,000, and the cost of rolling stock, &c., at £180 000. The line is to be completed in three years.—*Board of Trade Journal.*

Glasgow.—Owing to the great demand for a later car service from the centre of the city during the fortnight of the General Election, the general manager has arranged a late service which is being run until nearly 1 a.m. over all the principal routes.

Llandudno.—The question of the extension of the electric tramway from Llandudno through Conway to Colwyn Bay was again discussed at the meeting of the Colwyn Bay U.D.C. on Tuesday, 18th inst., when a letter was received from Mr. Sellon (chairman of the Llandudno Electric Tramway Co.), suggesting that the Council and the company should come to an agreement as to the extension of the line to Old Colwyn on the basis of the decision of the Light Railway Commissioners last month. The Council resolved to meet the company as soon as it was in receipt of the draft agreement promised by the company. Under this the company is to pay £3,000 to the Council.

Perth.—Mr. P. Fisher, tramway manager, Dundee, has reported to the T.C. on the tramways. He recommends a Sunday service of cars, more frequent running and a reduction of the staff. As to the extensions of the system, he expresses his disapproval of any scheme for the extension of the Dunkeld Road route in the meantime, and is also averse to the opening of a new route to Jeanfield. Another recommendation is that the tramway line in High Street should be doubled, at least from the Post Office to the foot of High Street. The report will be fully discussed by the T.C.

Southampton.—Application is to be made to the L.G.B. for sanction to borrow £600 for additional meters. One of the two tramcars now in course of construction is to be fitted with a new long-wheel-base truck built by the Brush Co., and the other is to be fitted with a similar truck to those at present in use. Four cars for the Northam route are to be built and material is to be ordered for two other cars of the bogie type. Application is to be made to the L.G.B. for sanction to borrow £9,000, the estimated cost of 14 new cars (12 cars at £600 each and two cars at £900 each). The general manager is to proceed with the preparation of the specifications, drawings, and bills of quantities in connection with the construction of tramways from the Clock Tower to the Northam Toll Bridge.

U.S.A.—It is stated that the New York, New Haven and Hartford Railway is considering the construction of a tunnel under Boston, to link up the two terminal stations, and that it is proposed to electrify the suburban lines of the New Haven and Maine Railways.

Whitworth.—The U.D.C. has applied to the B. of T. for a loan of £39,416 for the construction and equipment of the tramways.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—According to the report for 1906 on the telegraph and telephone systems of Brazil, there were 27,635 kilometres of lines and 51,353 of wire, as well as 78 kilometres of cables; 946 interruptions occurred during the year. Inland traffic increased from 1,448,668 telegrams in 1905 to 1,642,582 in the year under review, while 48,031 international telegrams were sent, 45,109 received and 10,126 passed in transit. In view of the objects of German cable enterprise, it is interesting to note that the Western Telegraph Co. transmitted to and received from Northern Brazil 166,183 telegrams, and the figures for Southern Brazil were 47,409. Transit telegrams handled by the same company numbered 228,192. The South American Co.'s share of traffic amounted in all to 20,118 telegrams. Receipts amounted to 11,897,944 fr. and expenses to 14,444,015 fr. The Government telephonic system dealt with 312,854 conversations; it is impossible to state the figures of private enterprises, of which there are a good many.

Cable Communication.—A Committee of the Australian Senate has reported that present conditions give an imperfect cable service and insufficient news of various parts of the Empire, and has recommended the completion of the All-Red route, in order to bring about a reduction in the charges for Press cables. The restriction prohibiting newspapers supplied with cable news by the Cable Association from publishing news received through any other source is condemned as being exceedingly injurious, and it is recommended that steps be taken to make such restrictions impossible.

Canada.—The appropriation of $600,000 made by the Alberta Legislature for the extension of the provincial telephone system is already nearly exhausted. Of rural lines, 500 miles have been completed, radiating from various points in the province, and giving telephone connection to 500 farmers. By the middle of January it was expected that another 200 miles of rural lines connecting 200 farmers' telephones would be completed. Of the long-distance pole lines 150 miles have been constructed.—*Commercial Intelligence.*

Cape Colony.—The Cape Legislative Assembly proposes to expend on telegraph extensions, £10,100; and on wireless telegraph installations, £10,000.—*Board of Trade Journal.*

Code Telegrams.—Canada and the United States, the countries where the liberal counting of telegraphic words originated, which is now the subject of so much controversy in the United Kingdom, have, so far as inland telegrams are concerned, taken some stand against public abuses. The new rule for counting only recognises words of five letters instead of 10, and, as is only natural, Canadian manufacturers are complaining of the matter to the Railway Commission, as they claim that it means doubling their telegraph bill. The case was heard by the Commission on December 22nd, and after a lengthy examination, the change in the rule for counting was authorised, with the exception that it was not to come into force until July, 1910, instead of December 1st, 1909, so as to give merchants time to re-adjust codes.

Roumania.—The Government report on the telegraph and telephone systems for the year 1907 states that the former system consisted of 324 kilometres of line, and 1,232 of wire, with 238 offices. Inland traffic amounted to 2,161,547 telegrams, and international traffic to 1,011,511, the total number of words dealt with being 41,249 754. Receipts for international traffic totalled 750,780 fr., and expenses, 1,153,373 fr. Wireless systems on ships dealt with 159 radio-telegrams, of which 32 were on official business. The telephone system consisted of 27,743 kilometres of line, and 44,469 of wire, and call stations numbered 8,012. The joint receipts of the two systems were 4,387,918 fr.

Telephone Case.—Last week the National Telephone Co. sued a firm of printers in the City of London for £5 15s. 7d., for a year's telephone service in advance. The defendants had removed to new premises, and alleged that a promise was made that they should retain their telephone number unchanged; it proved, however, that they were now in the area served by a different exchange, and the same number could not be given. They had been without the use of their telephone since August last. Judgment for the plaintiffs, with costs.

Telephone Combine.—The interests involved in the securing of a controlling interest in the United States Telephone Co. and the Cuyahoga Telephone Co., the former operating in Ohio and part of Michigan and the latter in Cleveland, are stated to be a control in the Toledo Home Telephone Co., the Citizens' Telephone Co., of Columbus, the Indianapolis Telephone Co., the New Long-Distance Telephone Co., of Indiana, and the New Telephone Co., of Indianapolis. The system has 101,500 telephones and 40 000 long-distance lines in Ohio, Indiana and Michigan, and an aggregate capital of bonds $12,500,000, preferred stock $4,500,000, and common stock $11,000,000.

Wireless Telegraphy.—It is reported that the German Telefunken Co. has secured a contract for the erection of radio-telegraphic stations along the coast of Argentina.—*The Times.*

A conference of representatives of the Admiralty, the Commonwealth, New Zealand and Fiji, which recently met at Melbourne to consider the question of wireless telegraphy in the Pacific, recommends the establishment of high-power stations at Sydney, Doubtless Bay (New Zealand), Suva and Ocean Island, and medium-power stations in the New Hebrides and Solomon Islands. All the stations are to be controlled by the Government.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

MELBOURNE.—Seven sections of branching multiple magneto switchboard for the P.M.G. See "Official Notices" January 7th.

February 22nd.—Wireless telegraph installation (*a*) in or near Sydney, N.S.W., and (*b*) in or near Fremantle, Western Australia. See "Official Notices" January 7th. The *Times* states that the conditions have been modified; in order to ensure continuous communication with New Zealand, tenderers are requested to include in their offers quotations for a range of 1,250 nautical miles. It has further been decided to give preference to a system which will emit a definite musical note.

SYDNEY.—Two junction-line sections of common-battery switchboard for the P.M.G. See "Official Notices" December 24th.

SOUTH AUSTRALIA.—Telegraph and telephone material for the P.M.G. See "Official Notices" December 24th.

Ashton-under-Lyne.—February 9th. Condensing plant, cooling tower, exhaust turbine and 400-KW. D.C. generator, and one electric balancer for the Electricity Committee. See "Official Notices" to-day.

Belfast.—January 31st. Two water-tube boilers, superheaters, mechanical stokers, economisers, pipework, &c., for the Tramways and Electricity Department. See "Official Notices" January 7th.

Belgium.—February 2nd. Tenders are being invited by the Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), for the supply and laying of the underground electrical mains in connection with the new electric railways in the centre district.

Birmingham.—February 1st. Stores for the Tramways Department. See "Official Notices" December 31st.

Bolton.—February 10th. One Lancashire boiler, with superheater, for the Electricity Committee. See "Official Notices" to day.

Brandon and Byshottles (Co. Durham).—February 4th. Supply of electricity to public lamps, for the U.D.C., for a year. Surveyor, Langley Moor, Durham.

Bristol.—January 31st. Electric lighting of the passenger station at the Royal Edward Dock, Avonmouth, for the Council's Dock Committee. See "Official Notices" January 14th.

Cheltenham.—January 29th. E.L. fittings for a year, for the T.C. J. S. Pickering, Borough Surveyor.

Germany.—The municipal authorities of Stolp-in-P. are about to invite tenders for the establishment of a central electric lighting station in the town at an estimated cost of £100,000.

Halifax.—February 7th. Stores and materials for the Corporation Tramways and Electricity Departments. See "Official Notices" January 14th.

Launceston (Tas.).—February 7th and March 21st. (*a*) About 1,100 tons of steel tram-rails and fastenings; (*b*) rail bonds and accessories. Regarding (*a*) apply to Messrs. J. Terry and Co., 7, Great Winchester Street, London, E.C.; regarding (*b*) apply to Town Clerk, Town Hall, Launceston. Deposit one guinea in each case.

London. — STEPNEY. — January 24th. Boilers and accessories; turbo-generator accessories; converting plant; switchgear, &c., for the B.C. Electricity Supply Committee. See "Official Notices" January 7th.

February 4th.—The Institution of Electrical Engineers is inviting tenders for a complete system of electrically-operated clocks for its new premises. See "Official Notices" January 14th.

ISLINGTON.—January 27th. Electrical and engineer's stores, &c., for one year for the Council. See "Official Notices" January 14th.

February 2nd.—Electric light wiring and fittings for Cow Lane Elementary School, Rotherhithe, for the L.C.C. See "Official Notices" to-day.

Newcastle-on-Tyne.—January 29th. Electric crane for the Quayside, for the T.C. City engineer, Town Hall.

Newport (Mon.).—January 24th. Stores for the Electricity and Tramway Department. See "Official Notices" January 14th.

Plymouth.—January 25th. Stores for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 7th.

Spain.—February 26th. The Spanish Ministry of public works is inviting tenders for the concession for the construction and working of an electric tramway in Bilbao, between Calle de Fernandes del Campo and the railway station of the Bilbao-Santander Railway Co. Tenders are to be sent to, and particulars may be obtained from, La Direccion General de Obras Publicas, Madrid.

The municipal authorities of El Viso (Province of Cordoba) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Worksop.—February 2nd. Underground cables for the U.D.C. See "Official Notices" to-day.

CLOSED.

Belgium.—Twelve concerns—five each Belgian and German, and one each French and British—submitted tenders to the municipal authorities of Ixelles, Brussels, for the supply of a large quantity of low-tension armoured cables required in connection with the electric lighting undertaking. The British firm that competed was the British Insulated and Helsby Cables, Ltd., of Prescot, Lancs.; they were, however, underbidden by the German manufacturers, the lowest tender being that of the Felten and Guilleaume Co., of Mulheim-am-Ruhr.

La Société Nationale des Chemins de Fer Vicinaux, of Brussels, has just placed a contract with the Société des Ateliers de Construc-

tions Electriques, of Charleroi, for the supply of the electrical equipment of 70 passenger carriages for electrical railways. The value of the contract is roundly £16,000.

Carlisle.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for overhead cable from the works to Holme Head, at £799.

Glasgow.—The Tramways Committee has recommended acceptance of the following:—

Overhead line material.—British Insulated and Helsby Cables, Ltd.
Cast-iron controller backs.—British Westinghouse Co., Ltd.

The T.C.'s Electricity Committee on Works recommends the following:—

Switchgear for Yorkhill sub-station.—Messrs. Ferranti, Ltd., £292 (lowest tender).
Additions to and alterations on two continuous-current generators, at St. Andrews Cross.— Brown, Boveri & Co., Ltd., at £120 each.
Creosoted wooden troughing.—Robinson, Dunn & Co.
Metal bins for Port Dundas station.—Estler Bros. (£168).

Gloucester.—The T.C. has accepted the following tenders for tramway supplies for a year:—

John Brown & Co., Ltd., Sheffield.—Car wheel tires.
National Rail and Tramways Co., Ltd., Liverpool.—Brake blocks.
S. J. Vinson & Co., Gloucester.—Round and square mild steel.

London.—WESTMINSTER.—The City Council received the following tenders for providing and fixing eight 400-c.p. metallic-filament lamps in the 1st class swimming bath in Great Smith Street, in place of the existing arc lamps, which are in a defective condition:—

L. White	£83
Leo. Sunderland & Co.	59
Coleby & Co.	55
Belshaw & Co...	50
Speedy Eynon & Co.	39
Drake & Gorham.. .. .. (accepted)	32

SOUTHWARK.—The B.C. has accepted the tender of the St. Pancras Iron Works Co., Ltd., for the supply of 100 ft. of floor lights at 3s. 11d. per foot super, for extending the present switchboard gallery at the generating station.

Pretoria.—The Town Council has accepted the tender of Messrs. Jowett, Naylor & Williams, at £38,016 (the lowest), for trackwork and sundry works, in connection with the new electric tramway system.

Sheffield.—The T.C. has accepted the tender of Ferranti, Ltd., at £274, for the supply of 32 oil-break switches, time-limit overload relays, current transformers, &c., to replace the existing fuses on the switchboard at the Sheaf Street Station. The general manager is to fix the oil-break switches and other apparatus, at £277. The tender of the British Insulated and Helsby Cables, Ltd., for six miles figure-8 copper trolley wire for the Tramway Department has been accepted.

Southampton.—The T.C. has placed an order with the Lagonda Manufacturing Co. for a Weinland boiler tube cleaner for the electricity undertaking, at £45; and has accepted the tender of Messrs. A. Ransome & Co., Ltd., at £32 for a vertical spindle moulding machine for the tramway undertaking; and an order is to be placed with Messrs. Dick, Kerr & Co., for six car equipments, at £240 per car.

Winton.—The contract for electric lighting and supply of fittings for the Eccles new Council school at Beech Street, Winton, has been secured by the Globe Electrical Co., of Manchester.

FORTHCOMING EVENTS.

Physical Society.—Friday, January 21st. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Polarisation of Dielectrics in a Steady Field of Force," by Prof. W. M. Thornton; and "The Use of Mutual Inductometers," by Mr. A. Campbell.

Institution of Mechanical Engineers.—Friday, January 21st. At 8 p.m. Paper on "Ninth Report to the Alloys Research Committee: on the Properties of some Alloys of Copper, Aluminium and Manganese," by Dr. W. Rosenhain and Mr. F. C. A. H. Lantsberry.

Northampton Institute Engineering Society.—Friday, January 21st. At 5.45 p.m. Paper on "Choice of Prime Movers for Power Stations," by Mr. E. T. Driver.

Institution of Electrical Engineers (Newcastle Section).—Monday, January 24th. At 8 p.m. At the Armstrong College, Newcastle. Paper on "The Safety Devices in Coal Cutters," by Mr. H. J. Fisher.

Institution of Electrical Engineers (Manchester Section).—Tuesday, January 25th. At 7.30 p.m. At the University, Manchester. Paper on "Equitable Charges for Tramway Supply," by Mr. H. E. Yerbury.

Institution of Electrical Engineers (Leeds Section).—Wednesday, January 26th. At 7.15 p.m. At the University, Sheffield. Paper on "Equitable Charges for Tramway Supply," by Mr. H. E. Yerbury.

Institution of Electrical Engineers (London).—Thursday, January 27th. At 8 p.m. At the Institution of Civil Engineers. Paper on "Equitable Charges for Tramway Supply," by Mr. H. E. Yerbury.

Institution of Civil Engineers.—Friday, January 28th. At 8 p.m. Students' meeting. Lecture on "Some Uses of Mechanical Power in Engineering Construction," by Mr. H. F. Donaldson.

Ilford Tramway Appointment.—Ilford U.D.C. has received 79 applications for the post of tramways manager. The appointment will be made on January 24th.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, January 24th.—"A" Company. Technical drill, 7 to 9.30 p.m.
Tuesday, January 25th.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, January 26th.—Gymnasium, 6.30 to 9.30 p.m.
Thursday, January 27th.—"C" Company. Technical drill, 7 to 9.30 p.m.
Friday, January 28th.—"D" Company. Technical drill, 7 to 8.30 p.m.; infantry drill, 8.45 to 9.45 p.m.
Saturday, January 29th.—"B" Company. Week-end run at Coalhouse. Parade at Fenchurch Street Station 3.15 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

Annual Dinner of Mr. Wordingham's Staff.—The first annual dinner of the London and Overseeing Staff of the Superintending Electrical Engineer's Branch of the Admiralty took place at the Holborn Restaurant on Saturday, January 15th, when Mr. C. H. Wordingham, M.I.C.E., &c., superintending electrical engineer, presided. There was a large attendance, and a most enjoyable evening was spent. In proposing the chairman's health, Mr. Edge, in a few well-chosen remarks, alluded to the great advances that had been made in the electrical equipment of H.M. ships, &c., since the advent of the chairman, whom he was pleased to see presiding that evening. The toast was received with acclamation and drunk with musical honours. The chairman, in his reply, spoke in eloquent terms of the zeal and ability displayed by the whole of his staff, and paid a high tribute to the character and work of the overseers. Mr. Green proposed the toast of the Overseers, in a humorous speech, and Mr. Broomfield responded. The vocal and instrumental programme was carried out entirely by members of the staff. The committee for the arrangements were Messrs. Broomfield, Edge, Rogers and Tizzard.

"The Steady Job."—By "Binnacle."

The giddy rush of "mediocs" to find a steady job
Can never mend this country's lax condition,
Our safety rests with supermen who rise above the mob,
And show us how to cultivate ambition.

What matters if the ineffetes be trampled under foot
By hustlers in their meteoric flight,
So long as evolution follows giving men the boot,
Who act upon our progress as a blight.

E'en marriage in the future will scarcely merit thought
Excepting as a minor avocation,
And the raising of a family by those who do get caught,
Will surely lead to speedy ruination.

The man who leaves this world of sin no better for his stay,
Can never hope to linger on the list,
As supermen will struggle for his job and for his pay
Because he holds no warrant to exist.

In course of time the steady ones will vanish from our ken,
The sweaters being left to run the show,
And every works and office will be filled by supermen
Who fear to tackle nothing they don't know.

"Survival of the fittest" will rule the frenzied throng,
And uncertainty of tenure goad the mob,
Of harpies who have banished every thought of right or wrong,
To fight for every temporary job.

Tramway Staff Dance.—The staff of the Dundee and Broughty Ferry Tramway Co. held their annual social and dance last week. Mr. D. Fisher, the manager, presided.

A Middlesbrough Rolling Mill Equipment.—An electrically-operated 28-in. cogging mill equipment recently installed by Messrs. Dorman, Long & Co., Britannia Works, has fully justified their courage and enterprise in being one of the first to realise the advantages of the electrical operation of this class of machinery. The mill is a 28-in. cogging mill, and on November 26th last during a night shift of 12 hours it cogged 92 ingots 14 in. × 12 in., down to both 6 in. and 5 in. billets as required, in 4 hours 41 min. actual cogging time, the total weight cogged being 105 tons. The mill, which was built by Taylor & Farley, of West Bromwich, and the electrical equipment, which was designed and built by the British Thomson-Houston Co., of Rugby, gave no indication that they were then near their limits. The output for which the mill and equipment were originally designed was 15 tons per hour, with a possibility of dealing with 22½ tons per hour for two hours continuously if required. It will be noted that during the shift referred to, the output of the mill was 22 tons per hour for 4¾ hours continuously. In this mill an ingot of from 22 to 25 cwt., 14 in. × 12 in., can be cogged down to a 5-in. billet in 2¼ minutes. We understand that this is the fastest cogging plant in the North. It reflects great credit, not only on the users for the manner in which the mill is operated to obtain these results, but on the designers and builders of the mill and its equipment.

Institution and Lecture Notes.—Institution of Mining Electrical Engineers.—A meeting of the South Wales Section of the Institution was held at Cardiff, January 8th. Owing to the unavoidable absence of the President, Mr. Sydney F. Walker, through a railway accident, the chair was taken by Mr. G. L. Stone. The meeting was well attended, not only by electrical engineers stationed at collieries, but also by colliery managers and other engineers connected with mining in general. A General Purposes Committee was appointed, representing each district throughout the whole of South Wales. The membership is gradually creeping up, and the secretary, Mr. E. Ivor Davies, 96, Great Western Street, Moss Side, Manchester, will be pleased to answer any inquiries sent to him at the above address.

The next meeting will be held at the Park Hotel, Cardiff, on January 29th, when the paper written by the President, Mr. W. Maurice, will be discussed.

Royal Institution.—The series of Christmas lectures at the Royal Institution by Mr. W. Duddell, which concluded on the 8th inst., proved exceedingly popular. That the lectures were interesting and instructive goes without saying, in view of the personality of the lecturer; the especially noteworthy feature of this series, however, has been the interest evinced by the Press. As the lectures traversed practically the whole field of electrical science, we trust that the result will be an elevation of the standard of scientific accuracy observed in the pages of the lay Press.

Association of Engineers-in-Charge.—On January 12th Mr. T. W. Aldwinckle, F.R.I.B.A., read a paper on the warming and ventilation of public buildings and factories—a subject on which little reliable information is available, in spite of its great importance.

Institution of Mechanical Engineers.—On the 7th inst., Prof. W. R. Eckart, of Leland Stanford Junior University, California, read a paper on the application of the Pitot tube to the testing of impulse water-wheels. His conclusions are that the use of the Pitot tube and a contraction-gauge for the determination of the discharge from large nozzles under high heads is both practicable and accurate, while the apparatus is inexpensive and portable. Amongst other results cited, the efficiency of a nozzle delivering a jet with a cross-section of 0·253 sq. ft., and working under a pressure of 350·5 lb. per sq. in., was found to be 98·6 per cent. The maximum velocity of the jet was 229·9 ft. per second, and the discharge was 3,586 lb. per second. Of the power in the jet, 29·2 per cent. was lost in bucket friction and eddies, 1·9 in the residual velocity of discharge, 2·8 in friction and windage of generator and wheels, 1·2 in generator iron and armature, and 64·1 per cent. was delivered to the switchboard, the remaining 0·8 per cent. being ascribed to other hydraulic losses.

At the Welcome Hall, Fore Street, Devonport, on the 14th inst., under the auspices of the Devonport Dockyard Electrical Fitters' Association, Mr. Z. H. Kingdon, electrical engineer of the Yard, gave a lecture on "Electric Transmission of Power." Mr. W. Maker presided over a good attendance, and an interesting lecture, illustrated with lantern slides, was given.

Stolen Telephone Wires.—At Salford recently, before the Stipendiary Magistrate, Robert Martin, Harold Dodd and John E. Bradshaw were charged, the two former with stealing telephone wire, the property of the National Telephone Co., and Bradshaw with receiving 69 lb., knowing it to have been stolen. Mr. Newman, who prosecuted, stated that for some time great lengths of wire had been stripped from the company's standards. Dodd pleaded guilty; but, on behalf of Bradshaw, Mr. Holmes contended that the wire was purchased in the ordinary course of business. It was stated that a charge of doing malicious damage to the telegraph wires would also be preferred against Martin and Dodd. All the prisoners were committed for trial at the sessions. Mr. A. R. Kempster, licensed broker, of Lower Broughton, was then fined 21s. and costs for failing to enter in his book the description and price of 58 lb. of the wire that he purchased from Bradshaw.

Parliamentary.—Standing Orders.—The following Bills have passed the Examiners to the House of Commons:—Baker Street and Waterloo Railway, Charing Cross, Euston and Hampstead Railway, Lancashire Electric Amalgamation, Havant Gas and Electricity, Yorkshire Electric Power, Bishops Stortford, Harlow and Epping Gas and Electricity, Metropolitan Railway, Wimbledon and Sutton Railway, Cavehill and Whitewell Tramways, Central Argentine Railway, and Devonport and District Tramways, and have been ordered for first reading.

Are Ions Visible?—*Nature* quotes an article in the *Physikalische Zeitschrift* for December 15th, 1909, by Dr. J. J. Kossonogow, of the University of Kiev, on the application of the ultramicroscope to the study of the phenomena of electrolysis. He finds that when an electrolyte is examined under the ultramicroscope, at the moment the current is switched on there appear in the field of view a number of bright points of light which travel towards the electrodes with velocities of the same order of magnitude as have been found for the ions. The path may be deviated by means of a magnet. When a point reaches an electrode it appears to attach itself and take a crystalline form. None of these appearances is observed in the case of a non-electrolyte, and the author considers he has proved beyond the possibility of doubt that the ultramicroscope provides a powerful means of studying directly the motions of the ions in electrolysis.

Seeing by Wire.—The *Daily Mail* is still preoccupied with television. On Thursday last, dismissing previous inventions as ingenious but frightfully costly, our contemporary declared that a new invention of MM. Rignoux and Fournier had made the transmission of images by wire a "practical possibility." Previous inventions required 4,000 or 5,000 wires; the new invention does it with one!

From the description given of the apparatus, it is clear that the invention is in the stage of hypothesis. As will, of course, be obvious, it involves the transmission of separate impulses at the rate of 10,000 or 20,000 a second over the single wire, and the synchronisation of the transmitting and receiving apparatus to an almost inconceivable degree of precision.

It will be time enough to believe in this "practical possibility" when we see it.

Tungsten Lamp Tests.—The Westminster Electrical Testing Laboratory has just completed a series of life tests on 15 of the principal makes of tungsten-filament lamps, the results of which will be supplied to subscribers only. Four lamps of each make were tested at 200 volts and 32 c.p.

Elektron.—This is the name given to a new magnesium-aluminium alloy having a specific gravity of 1·75 to 2, whilst that of aluminium is 2·7 to 3. The alloy is silver-white, can be cast, wrought and polished, and has a tensile strength of 11½ tons per sq. in. cast, 22 tons wrought and drawn. It is expected to be very useful in the construction of rigid airships, and for other purposes requiring extreme lightness combined with great strength, as, for instance, electrical instruments.

The Census of Production.—In the Blue Book that has been issued this week, summarising the results of the returns received under the Census of Production Act, 1906, the following figures appear relating to the output of engineering factories, including electrical engineering:—

(*a*) Gross output (selling value)	£101,599,000
(*b*) Materials used (cost)	48,323,000
(*c*) Work given out. Amount paid to other firms	3,851,000
(*d*) Net output. Excess of (*a*) over (*b*) and (*c*)...	49,425,000
(*e*) Persons employed, total	455,561
(*f*) Net output per person employed	£108

It is stated that the value of the finished products of the engineering industry manufactured in 1907 was—

General engineering...	£76,238,000
Electrical engineering	13,782,000
	£90,020,000

"Statistician," analysing and commenting upon the returns in the *Westminster Gazette*, says:—"The imports of steam engines, we learn, are insignificant. The value of the imports of machinery other than electrical is about 9 per cent. only of the value of the total production of the United Kingdom; that of electrical machinery scarcely 14 per cent.; of electrical goods and apparatus but 26 per cent.; of telephone and telegraph cables only 12 per cent.; and, in still diminishing quantity and value, of electrical wires and cables just 5 per cent. On the other hand, the output of our engineering factories in 1907 showed an increase in value, over that of 1906, of about 10 per cent."

Electric Light for Bakers' Ovens.—A correspondent asks for any information regarding a suitable device for the lighting of a baker's oven by electricity. Glow lamps and flexible fail through the heat; the lamp bursts, and the insulation of the leads is ruined. The light must be placed inside the oven, and there remain for at least ten minutes. The system of supply is 250 volts d.c.

Cinematograph Regulations.—The new Regulations for securing safety at cinematograph exhibitions, which came into force on January 1st, include clauses relating to the use of electric light, as follows:—

5. Where electric light is reasonably available for use in the building, no other illuminant shall be used for the purpose of the exhibition. In any case no illuminant other than electric light or limelight shall be used for such purpose.

6. *Electric Light.*

(*a*) Within the enclosure (surrounding the apparatus) the insulating material of all electric cables, including "leads" to lamps in the enclosure, shall be covered with fire-resisting material.

(*b*) There shall be no coils of slack electric cable within the enclosure. The "leads" to the apparatus shall be kept well apart both within and without the enclosure, and so run that the course of each may be readily traced.

(*c*) No current at a higher pressure than 110 volts shall be used within the enclosure.

(*d*) The cables for the cinematograph apparatus shall be taken as a separate circuit from the source of supply, and there shall be efficient switches and fuses inserted at the point where the supply is taken, and in addition, an efficient double-pole switch shall be fitted in the cinematograph lamp circuit inside the enclosure.

(*e*) Resistance frames shall be constructed entirely of fire-resisting material, and they shall, if reasonably practicable, be placed in a room apart from that used for the exhibition. If accessible to the public, they shall be protected by a wire guard or other efficient means. With the exception of a small resistance for regulating purposes, they shall be placed outside the enclosure.

12. The general lighting of the auditorium and exits shall not be controlled solely from within the enclosure.

Clause 2 (*e*) also provides that the necessary pipes and cables shall enter the enclosure through efficiently bushed openings.

Electrical Football League.—This competition, which is confined to clubs associated with electrical supply and manufacturing companies in the London district, has now reached an interesting stage, and the table below, corrected up to the 17th inst., shows the positions of the various teams. The hon. secretary of the League, Mr. H. W. Roberts, of 71, Queen Victoria Street, E.C., will be pleased to hear from any club wishing to compete next season :—

	Played.	Won.	Lost.	Drawn.	Goals. For.	Agst.	Pts.
Metropolitan Electric	4	4	—	—	15	6	8
City of London Electric ..	2	2	—	—	8	2	6†
St. James' Electric	5	2	3	—	19	17	6*
County of London Electric ..	3	1	2	—	8	14	2
Robertson & Osram Electric ..	2	—	2	—	4	8	—
General Electric..	2	—	2	—	1	8	—

† Points awarded in match arranged against County of London.
* Points awarded in match arranged against General Electric; also match against Robertson & Osram, in dispute.

Appointments Vacant.—A working engineer is required to take charge of the electrical plant and other machinery at the Walthamstow U.D.C.'s sanatorium (42s). Assistant engineer for the Middleton Corporation Electricity Department (£100). See our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Wakefield T.C. has appointed MR. B. T. HAWKINS, charge engineer, as station superintendent, at a salary of £140 per annum; MR. GEO. VAREY, mains superintendent, as mains engineer, at a salary of £140 per annum; and MR. S. W. GARSIDE, as commercial engineer.

MR. E. J. FUSSELL, chief clerk of the Croydon Electricity Department, has resigned. A successor is to be appointed at a commencing salary of £180, rising to £230.

The first annual dinner of the combined staffs of the Dartmouth and Newton Abbot Electricity Works took place at the "Dolphin Restaurant," Newton Abbot, on Thursday, 13th inst. In the unavoidable absence of Mr. G. E. Smith, the engineer and manager, the chair was taken by MR. A. C. EVANS, and after the repast the evening was spent in harmony. Songs, &c., were given by the members of both staffs, and during the proceedings a canteen of cutlery and plate was presented to the chairman by Mr. H. C. Babb, on behalf of the combined staffs, on the occasion of his approaching marriage. Mr. Evans suitably responded.

The Leek U.D.C. has appointed MR. W. B. CHILD, of Worcester, as assistant electrical engineer, at a salary of £100 per annum.

The directors of the County of London Electric Supply Co., Ltd., have made the following appointments:—MR. BACON, who has been 13 years in the company's service, has been promoted from resident engineer at City Road station, to be superintending engineer over the company's stations; MR. W. G. HARDY, promoted from first assistant engineer to be resident engineer, and MR. L. ROSEVEARE from engineer-in-charge to first assistant engineer at City Road station; MR. H. B. JOHNSON, promoted from first assistant engineer, to be resident engineer, and MR. F. C. SELLENS from engineer-in-charge to first assistant engineer at Wandsworth station.

Tramway Officials.—The Bournemouth T.C. has appointed MR. H. HARTLEY, rolling stock superintendent to the Birmingham and Midland Tramways Co., rolling stock superintendent at a salary of £156 per annum, rising to £175 in a year.

The Tramways Committee of Sheffield Town Council has decided in favour of the salary of MR. H. E. YERBURY, chief electrical engineer, being increased from £450 to £500 per annum from the 1st inst.

General.—Our Cape Town Correspondent writes:—"PROF. PAYNE, of the South African College, has been appointed to the Chair of Engineering at the Melbourne University. This appointment will mean a distinct loss to the Cape Society of Civil Engineers. Prof. Payne has been for years past an enthusiastic and energetic member of the Society, and has filled the office of hon. treasurer, besides discharging the duties of secretary. At the annual meeting recently held he was elected president for 1910, and was hoping during his year of office to further the movement for extending the Society's sphere of operations under its new title of the South African Society of Civil Engineers."

MR. HORACE BOOT, consulting engineer, of Westminster, left England on the 18th inst. to make reports for various companies abroad. He expects to be away until April; in the meantime, his representative will be MR. R. V. WEARE, the resident engineer of the Chichester Electric Light and Power Co., Ltd.

MR. T. A. NUNWICK has removed to 32, Prince's Chambers, John Dalton Street, Manchester. His telephone number remains No. 7,280 Central. He represents Messrs. Dorman & Smith, Messrs. C. J. Thursfield & Co., the Oliver Arc Lamp, Ltd., and the Standard Cable Co., Ltd.

MR. W. J. COLES, A.M.I.E.E., late of Messrs. Maxted, Knott and Coles, consulting engineers, of Hull, has commenced business as a consulting engineer at 231-232, Birkbeck Bank Chambers, High Holborn, London, W.C. As previously, he is specialising in electrically-driven machinery and cement works, and it has been arranged that he shall act for his late partners in electrical matters. Mr. Coles is also specialising in the selection of sites and equipment of works for foreign firms intending to manufacture in this country.

The Western Electric Co, Ltd, has been incorporated to carry on, as from December 1st, 1909, the business of the Western Electric Co. in the United Kingdom. MR. G. E. PINGREE has been appointed managing director of the new company, and MR. J. E. KINGSBURY, whose approaching retirement has been generally known for some time, will continue until the end of February in an advisory capacity and to facilitate the transfer of the business.

MR. T. E. MOTT, who has held the position of chief clerk to the Bridlington Corporation Electricity Department for over five years, is shortly leaving the service of the Department, having been unanimously appointed by the Council to a superior position in the Waterworks Department. Mr. Mott was selected out of 158 applicants for his new appointment.

Obituary.—MR. G. W. KING.—The death is announced from Glasgow of Mr. Geo. Wm. King, late manager of the Wrexham Tramway Co. He was 45 years of age. At the time of his death Mr. King had charge of the Greenock and Port Glasgow Tramways. He managed the Wrexham Tramways from the opening until May, 1906.

NEW COMPANIES REGISTERED.

C. F. Casella & Co., Ltd. (106,869).—This company was registered on January 6th, with a capital of £10,000 in £1 shares, to acquire the business carried on by C. F. Casella in London as C. F. Casella & Co., and to carry on the business of mechanical and electrical engineers and manufacturers, opticians, agents, printers, vendors of scientific instruments and apparatus, books, charts and medical and photographic appliances, &c. The subscribers (with one share each) are:—C. F. Casella, 11, Rochester Row, Westminster, scientific instrument maker; R. Miall, 11, Rochester Row, Westminster, scientific instrument maker; S. Miall, 116, Fore Street, E.C., solicitor. Private company. The number of directors is not to be less than three or more than eight: the first are C. F. Casella, L. M. Casella, R. Miall, S. Miall, and Capt. M. H. P. R. Sankey. (Remuneration, except C. F. Casella and R. Miall) £20 each per annum. Registered office, 11-15, Rochester Row, Westminster.

G. Pearson & Sons, Ltd. (106,938).—This company was registered on January 8th, with a capital of £2,000 in £1 shares, to take over the business of manufacturers of electrical accumulators and leather renovators carried on by G. Pearson, G. R. Pearson L. R. Pearson and O. R. Pearson at 154, Abbott Road, Poplar, as "Pearson's." The subscribers (with one share each) are:—G. Pearson, 154, Abbott Road, Poplar, E, manufacturer; G. R. Pearson, 154, Abbott Road, Poplar, E., manufacturer; L. R. Pearson, 154, Abbott Road, Poplar, E., manufacturer; O. R. Pearson, 154, Abbott Road, Poplar, E., manufacturer; N. R. Pearson, 154, Abbott Road, Poplar, E., manufacturer; Mrs. J. Pearson, 21, Westcliff Parade, Westcliff-on-Sea. Private company. The number of directors is not to be less than three or more than five; the first are G. Pearson, G. R. Peason, L. R. Pearson, O. R. Pearson and N. R. Pearson; qualification, £50; remuneration as fixed by the company. Registered by Jordan and Sons, Ltd., 116-7, Chancery Lane, W.C.

Tramways, Light and Power Co., Ltd. (106,915).—This company was registered on January 11th, with a capital of £10 in £1 shares, to carry on the business of electricians, engineers, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in plant and apparatus, &c. The subscribers (with one share each) are:—E. T. Church, 39, Hetherington Road, Clapham, clerk; J. A. Fuller, 110, Sirdar Road, Wood Green, N., clerk; J. H. Chapman, 28, Albacore Crescent, Lewisham, S.E., clerk; E. S. Harper, 19, Chevening Road, Kensal Rise, N.W., clerk; A. W. Lawson, 14, Rosebery Gardens, Crouch End, N., secretary; F. Snow, 20, Exeter Road, Cedars Avenue, Walthamstow, clerk; S. H. Penwarden, 7, Comely Bank Road, Walthamstow, clerk. Table "A" mainly applies. The company will be dissolved if all the shares are not taken up by February 10th, 1910. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Reid Brothers Engineers, Ltd. (106,918).—This company was registered on January 18th, with a capital of £30,000 in £1 shares, to adopt an agreement with J. Reid and E. J. Reid, and to carry on the business of electrical, telegraph and telephonic engineers, manufacturers of cash carrier systems, pneumatic tubes, &c. The subscribers (with one share each) are:—J. Reid, 26, Chesterfield Gardens, Finchley, engineer; E. J. Reid, Stanthorpe, Bexley Heath, engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. Reid and E. J. Reid (both permanent); qualification, £100; remuneration of first directors, £500 per annum; of other directors as fixed by the company. Registered office, 13, Wharf Road, City Road, London.

Western Electric Co., Ltd. (106,921).—This company was registered on January 10th, with a capital of £500,000 in £5 shares, to acquire the business and undertaking carried on in the United Kingdom by the Western Electric Co., of Chicago, Illinois, U.S.A., and to carry on in the United Kingdom or elsewhere, the business of dealers in telephones, telephonic, telegraphic, and electric lighting apparatus, instruments and machinery, electrical cables, wires, and goods, electricians, &c. The subscribers (with one share each) are:—F. R. Welles, Norfolk House, Victoria Embankment, W.C., manufacturer; G. E. Pingree, Norfolk House, Victoria Embankment, W.C., manufacturer. Private company. The number of directors is not to be less than three or more than seven; the first are F. R. Welles, G. E. Pingree and A. Williamson; qualification, one share. Registered by Bristows, Cooke and Carpmael, 1, Copthall Buildings, E.C.

Ebro Light and Power Construction Co., Ltd. (106,973).—This company was registered on January 13th, with a capital of £100,000 in £1 shares, to carry on the business of electricians, engineers, promoters and workers of tramways, railways, electric, hydraulic and other works, &c., and to adopt an agreement with A. Parrish. The subscribers (with one share each) are:—C. Maskell, 1, Queen Victoria Street, E.C., F.C.A.; W. R. Euton, 1, Queen Victoria Street, E.C., F.C.I.S. Private company. The first directors (the number not less than three or more than five) are to be appointed by the subscribers; remuneration, £500 each per annum. Registered by Slaughter and May, 18, Austin Friars, E.C.

Bradford Electrical Co., Ltd. (106,949).—This company was registered on January 12th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, engineers, workers of electricity, motive power and light, &c. The subscribers (with one share each) are:—J. Garnett, Hazel Bank, Daisy Hill, Bradford, milliner; W. A. Burrows, Croyland, Staveley Road, Shipley, cardboard box maker. Private company. The first directors are A. Whitehead and J. Garnett; qualification £5. Registered office, 56, Manningham Lane, Bradford.

Peel-Conner Telephone Works, Ltd. (106,673).—This company was registered on December 24th, with a capital of £124,000 in 120,000 preference shares of £1 each, and 80,000 ordinary shares of 1s. each, to adopt an agreement (1) with the General Electric Co., Ltd., of 71, Queen Victoria Street, E.C.; and (2) with M. S. Conner, to take over the business of manufacturers of and dealers in electric machinery and appliances, and especially telephones, telephonic apparatus, wires, cables, &c., formerly carried on by the said General Electric Co., Ltd., at Peel Works, Adelphi, Salford, to construct or lease telephone installations and apparatus and other electrical systems in any part of the world. The subscribers are:—G. Byng, 71, Queen Victoria Street, E.C., manufacturer, 500 shares; H. Hirst, 71, Queen Victoria Street, E.C., electrical engineer, 500 shares; M. S. Conner, Peel Works, Adelphi, Salford, electrical engineer, 500 shares; J. Fraser, 81, Copthall Avenue, E.C., chartered accountant, 500 shares; E. G. Byng, 71, Queen Victoria Street, E.C., manufacturer, 500 shares; P. P. Kipping, 71, Queen Victoria Street, E.C., manufacturer, 500 shares; F. Samuelson, 4-6, Queen Victoria Street, E.C., solicitor, 10 shares. Minimum cash subscription half the shares offered to the public. Purchase consideration, £3,400 in ordinary shares. The number of directors is not to be less than three or more than nine; the first are G. Byng, H. Hirst and M. S. Conner; qualification, 500 shares; remuneration (except managing director, if any) as fixed by the company; secretary, P. P. Kipping. Registered office, 31, Copthall Avenue, E.C.

G. Weston & Sons, Ltd. (106,631).—This company was registered on December 23rd with a capital of £5,000 in £1 shares (3,000 preference), to adopt an agreement between G. Weston, A. P. Stone and H. Hill, for the acquisition of the business carried on at 153, Fenchurch Street, E.C., Sheen, and Finchley, by the said G. Weston and A. P. Stone, and to carry on the business of electric light contractors, electrical engineers, gas light or heating contractors, ventilating engineers, &c. The subscribers (with one share each) are:—G. Weston, 153, Fenchurch Street, E.C., electrical engineer; A. P. Stone, 153, Fenchurch Street, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are G. Weston and A. P. Stone; qualification, £200; remuneration, £100 per annum, divisible. Registered office, 153, Fenchurch Street, E.C.

George H. Scholes & Co., Ltd. (106,845).—This company was registered on January 5th, with a capital of £8,000 in £1 shares (5,000 preference), to take over the business of an electrical and mechanical engineer, carried on by G. H. Scholes, at Blantyre Street, Chester Road, Manchester, as "George H. Scholes & Co." The subscribers (with one share each) are:—G. H. Scholes, A.M.I.E.E., 24, Kingston Road, Didsbury, Manchester; Mrs. L. C. Scholes, 24, Kingston Road, Didsbury, Manchester. Private company. G. H. Scholes is permanent governing director, subject to holding 1,000 of the ordinary shares allotted to him under purchase agreement, with £300 per annum. Registered office, 27, Blantyre Street, Chester Road, Manchester.

London Electric Treatment Institute, Ltd. (106,854).—This company was registered on January 5th, with a capital of £5,000 in £1 shares, to take over the business of an electric light cure and Electro-Therapeutic Institute carried on by A. F. Lambert, at 43 and 44, New Bond Street, W. The subscribers (with one share each) are:—A. W. Lambert, Thorneycroft, Richmond, engineer; A. F. Lambert, 43-44, New Bond Street, W., electrician. Private company. A. F. Lambert is sole permanent managing director, subject to holding 250 shares. Registered by Geo. J. Dowse & Co., 63, Moorgate Street, E.C.

Sheffield Electric Power Co. Ltd. (106,880).—This company was registered on January 6th, with a capital of £2,000 in £1 shares, to acquire the business relating to the hire of electric motors carried on by W. E. Burnand, and to carry on the same and the business of mechanical, electrical, and gas engineers, manufacturers of and dealers in electrical and mechanical appliances and devices, &c. The subscribers (with one share each) are:—W. E. Burnand, Dale View, Prospect Road, Totley Rise, Sheffield, electrical engineer; Mrs. E. Burnand, Tyneside, Denmark Road, Churchtown, Southport. Private company; W. E. Burnand is managing director. Registered office, Chippinghouse Works, Lowfields, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrelle, Ltd. (96,851).—Debenture dated December 8th, 1909, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. Cox, 14, Hereford Road, Southport.

Keighley Electrical Engineering Co., Ltd. (44,893).—Debenture dated December 16th, 1909, to secure £5,000, charged on the company's general assets. Holders: Sir James Smith, Edgbaston Hall, near Birmingham; and G. H. Claughton, The Priory, Dudley, Worcs.

W. G. Cannon & Sons, Ltd. (67,796).—A memorandum of satisfaction in full on November 5th and December 30th, 1909, of first and second mortgage debentures dated June 13th, 1906, and June 16th, 1908, securing £1,578 and £240 respectively, has been filed.

Cross and Cross, Ltd. (105,754).—Particulars of £1,000 debentures created December 11th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Minehead Electric Supply Co., Ltd. (74,382).—Particulars of £5,000 debenture stock created by resolutions of November 29th and December 21st, 1909, and secured by trust deed dated December 22nd, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Freehold and leasehold land and buildings at Quay Lane, Minehead, and Alcombe, Somerset, and the company's general assets. Trustees: T. Joyce and F. Risdon.

British Aluminium Co., Ltd. (41,104).—Charge on the company's undertaking and property, present and future, including uncalled capital (if any), dated December 17th, 1909, (supplemental to indentures of July 17th and August 20th, 1909), to secure £25,000. Holders: Sir Julius Wernher, Bt., L. Phillips, F. Eckstein and L. Breitmeyer. Also mortgage of even date, charged on the same property (supplemental to above mentioned indentures), to secure £25,000. Holders: W. Morrison, H. Morrison and J. A. Morrison.

Radyr Electric Co., Ltd. (95,997).—Particulars of £1,000 debentures created September 20th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £250. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Sunbeam Lamp Co., Ltd. (25,498).—Particulars of £25,000 debentures created November 25th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, except uncalled capital. No trustees.

A memorandum of satisfaction in full on January 1st, 1910, of debentures dated January 28th, 1904, securing not more than £10,000, has been filed.

A memorandum of satisfaction in full on February 15th, 1904, of second debenture dated November 27th, 1902, securing not more than £6,000, has been filed.

Electrolytic Alkali Co., Ltd. (64,360).—This company's annual return was filed on November 29th, 1909, when 99,965 preferred and 201,904 ordinary shares had been taken up (exclusive of 35 preferred and 314 ordinary forfeited) out of a nominal capital of £500,000 in 200,000 preferred and 300,000 ordinary shares of £1 each. £1 per share called up on 100,000 preferred and 127,218 ordinary (including the forfeited shares). £227,000 15s. paid (including £11 5s. on the forfeited preferred and £120 10s. on the forfeited ordinary shares). £75,000 4½ per cent. first mortgage debentures.

Munster Electric Lighting Co., Ltd. (100,269).—Issue on December 31st of £400 debentures, part of a series of which particulars have already been filed.

T. W. Broadbent, Ltd. (95,420).—This company's annual return, made up to September 3rd, 1908, was filed on January 11th, 1910. The entire capital of £5,000 in 440 preference and 560 ordinary shares of £5 each has been taken up. £5,000 has been received. Mortgages and charges: Nil.

Auxiliary Electrical Co., Ltd. (84,453).—This company's annual return was filed on January 3rd, 1910, when the entire capital of £70,000 in 14,000 shares of £5 each had been taken up. Two guineas each per share has been called up and £29,400 has been received. Mortgages and charges: Nil

Connolly Bros., Ltd. (44,277).—This company's annual return was filed on December 20th, when 3,942 shares had been taken up out of a nominal capital of £30,000 in £5 shares. £5 per share has been called up on 2,144 shares and £10,740 has been received. £8,990 is considered as paid on 1,798. Mortgages and charges, £32,500.

Pacific and European Telegraph Co., Ltd. (36,683).—This company's annual return, made up to November 9th, has been filed. The entire capital of £100,000 in £10 shares has been taken up. £4 per share has been called up and £40,000 has been received. Mortgages and charges: £99,400.

CITY NOTES.

Direct United States Cable Co., Ltd.

In their report for the half-year ended December 31st, 1909, the directors state that the revenue, after deducting out-payments, amounted to £60,338, as compared with £56,335 for the corresponding period of 1908, showing a difference of £4,003 in favour of the half-year under review. The working and other expenses for the same period, including income-tax, but exclusive of cost of cable maintenance, amounted to £25,290, leaving a balance of £35,048 as the net profit, making, with £3 596 brought forward from the previous half-year a total of £38,644. For the corresponding period of 1908, the working expenses and other payments amounted to £25,357. Interim dividends of 4s. per share for the quarter ended September 30th, 1909 (paid October 26th, 1909), and of 4s. per share for the quarter ended December 31st, 1909, payable January 31st, 1910, together amounting to £24,284 (both free of income-tax), have been declared, and after setting aside £7,500 to reserve fund account, the balance of £6,560 on the revenue account has been carried forward. The reserve fund account has been debited with £4,514 for the cost of cable maintenance and £1,500 for cost of land on which the station and dwellings stand at Ballinskelligs Station, and after being credited with interest on investments, profit on sale of securities, and amount set aside from revenue, the balance now amounts to £521,698.

Okonite, Ltd.—The directors have declared an interim dividend of 8 per cent. per annum (8s. per share) for the past quarter.

Official Announcements re Companies. — The following companies will be struck off the register in three months, unless cause is shown to the contrary:—

Aberavon District Tramways Syndicate, Ltd.
Automatic Telephone Co. (1903), Ltd.
British Electric Separating Co., Ltd. (registered April 20th, 1904).
British Seamless Rubber Co., Ltd.
Engineering Times Co., Ltd.
Everyday Electricity Publishing Co., Ltd.
Garcin Renault Electric Cars and Accumulators, Ltd.
India-Rubber Manufacturing Co., Ltd.
Kryptol Syndicate, Ltd.
Northern Electrical Supply Stores, Ltd.
Reliance Electric Co., Ltd.

British Columbia Electric Railway Co., Ltd.—Payment is announced, on January 31st, of a dividend at the rate of 5 per cent. per annum on the 5 per cent. non-cumulative preferred ordinary stock for the half-year ended December 31st, together with an additional dividend of 1 per cent. per annum for the same period.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation.—Further issue of 20,350 5 per cent. cumulative preference shares of £5 each, £3 paid, Nos. 120,001 to 140,350.

Commercial Cable Co.—Further issue of £17,826 sterling 500-year 4 per cent. debenture stock.

County of London Electric Supply Co.—Further issue of £50,000 4½ per cent. debenture stock.

Madras Electric Supply Corporation.—60,000 ordinary shares of £5 each, fully paid, Nos. 1 to 60,000, in lieu partly of the 5 per cent. construction debenture stock now quoted.

Mexico Tramways Co.—The directors have declared a dividend of 1½ per cent. for the quarter ended December 31st last.

MARKET QUOTATIONS.

Wednesday, January 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£10 10	10/- inc.
a Copper Sulphate	"	£19	10/- inc.
a Lead, Nitrate	"	£27	£1 dec.
a " White Sugar	"	£23 10	..
a " Peroxide	"	£33	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a " Chlorate	per lb.	8½d.	..
a " Perchlorate	"	8½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %) ..	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£75	..
b " Wire, in ton lots ..	"	£112	..
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£33 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	..
c " Tube (brazed)	"	9½d.	..
c " " (solid drawn) ..	"	7¾d.	..
c " Wire, basis	"	6¼d.	..
c Copper Tubes (brazed)	"	9d.	¼d. dec.
c " " (solid drawn ..	"	9d.	¼d. dec.
g " Bars (best selected) ..	per ton	£75	..
g " Sheet	"	£75	..
g " Rod	"	£75	..
e " (Electrolytic) Bars ..	"	£64	..
e " " Sheets ..	"	£80	..
e " " Rod ..	"	£68 10	..
e " " H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	"	8/8	..
f " Sheet	"	8/-	..
n German Silver Wire	"	1/6	..
h Gutta-percha, fine	"	5/6 to 6/6	..
h India-rubber, Para fine	"	7/8	¼d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	52/-	9d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£14	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 13	1/- dec.
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large ..	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11½d.	..
p " " rolled bars & rods	"	1/3	..
p " " rolled strip & sheet	"	1/3	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£116 to £117	£1 dec.
n " Wire, Nos. 1 to 16	per lb.	1/9½	¼d. dec.
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£27 10	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Victoria Falls Power Co.—The *Financial Times* learns from this company that they will shortly issue £900,000 of debentures, the balance of the authorised amount of £1,700,000, of which £800,000 was issued in November, 1908. "The issue of any further amount was postponed until the placing of a further sum of £900,000 preference shares was carried through in London. This was successfully accomplished last April, and it has since been open to the company to make its remaining debenture issue in Berlin as soon as convenient. The preparations necessary for a debenture issue in Germany are, we believe, much more troublesome than in this country, and in this particular instance the obtaining of documents in Africa and conveyance of them thence to Berlin for inspection by the Berlin Stock Exchange Committee have taken a great deal of time. As to the subscription of the issue, we hear from a very good source that there can be hardly any doubt of its success, and that, in fact, it is as good as placed already."

STOCKS AND SHARES.

Tuesday Afternoon.

The clash of party strife drowns even the clamour of the Stock Exchange markets, and the ceaseless wag of political discussion obscures even the desire to do business. The Stock Exchange had been rampantly enthusiastic over the prospects of a great Protectionist triumph, so when the first results turned out badly for the party, there was a general and a fairly substantial fall. This was continued on the Tuesday, but towards the end of the day there came a quiet rally in some of the stocks in which the drop had been heaviest.

The man of business, sated with the whole affair, again cries malison upon both and all sides, and is thankful that he is to be allowed to settle down peaceably to work after the storms and hurricanes of the past three or four weeks.

Monday's flatness of Consols led to a nasty break in the Home Railway Market, where prices had been put up gaily in advance of the Saturday elections. But the first dividend declarations helped to harden the market a little, although the tone continued unsteady.

The Tubes stocks are almost unaffected. City and South London remained very steady, in spite of the fact that last year the dividend announcement was made on January 12th. Metropolitans are down in spite of the dividend being at the rate of 1 per cent. —double what it was a year ago. Districts, too, are lower. Central Londons are quiet. Great Northern and City shares changed hands at 16s.

For such lower-priced shares with speculative possibilities, there is a good deal of quiet inquiry. One of the features in our lists this week is quite a big rise in British Electric Traction descriptions. It is said that the company's farthing-fare system has already had a good influence upon the takings. Evidently "somebody knows something," as the Stock Exchange puts it, because demand has sprung up from several quarters, and the market dealers declare that there is neither stock nor share about.

Concurrently, has arrived inquiry for London United Tramways Preference share and Debenture stock, both issues showing rises. Brush varieties are hardly mentioned. Metropolitan Electric Trams Preference are $\frac{1}{16}$ up. Underground Electric Prior Lien bonds improved, but the Incomes remain about 35.

On Friday in this week will be declared the annual dividend on the Deferred stock of the Anglo-American Telegraph Company. The market anticipation fluctuates between 23s. and 25s. per cent.; comparing with the 8s. per cent. distributed a year ago, but with 20s. and 35s. per cent. for 1907 and 1906 respectively. Prices are better again after their reaction. Eastern Extensions regained the 2s. 6d. dividend deducted from the price, and Eastern Ordinary, down a point, is *ex* 1¼ per cent. Great Northern shares are 10s. better, Westerns further rose 2s. 6d., and Direct United States Cable shares gained nearly a pound on the excellent report. A modest gain in Marconi replaces the small loss of last week.

Telephone issues are firm on the whole, but American Telephone and Telegraph stock is lower. National Telephone Preferences are good, and Monte Video hardened, Chiles being 2s. 6d. down, but *ex* 3s. dividend. There is a deal of quiet strength in the telegraph and telephone market, and as an instance of how securities are being picked up, it may be mentioned that numbers of small buying orders come in every day, many of them from abroad, for New York Telephone 4½ per cent. Debentures, the price of which has accordingly advanced to 99¾ *ex* coupon.

British Columbia Railway Deferred stock lost a point, and Anglo-Argentine Trams Second Preference are $\frac{1}{16}$ lower. Mexico Trams are on the mend once more, and show a rise of ½, while the bonds improved to 93½, and are buyers at that price. On the other hand, Mexican Light and Power Common shares are rather easier. Mexican Electric Light 5 per cent. First Mortgage Gold bonds advanced to 81. Kaministiquia Power bonds are also rather better.

Electricity Supply shares have barely budged as a result of the week's work. Chelseas picked up a little, Westminster Preference are ½ lower but *ex* 2s. 3d. dividend. A little inquiry from the North served to raise the price of Newcastle-on-Tyne Ordinary and Preference, ½ being the fraction gained in each case; and beyond these quite insignificant alterations, there is nothing to record.

Rubber shares monopolise most of the attention amongst industrials, and the market has had to put up with one or two checks lately, although the undercurrent is described as being sound, and there is certainly a heavy volume of business being done in many of the most popular issues. After the election, it is anticipated that the stream of new issues will set in all the more strongly from its having been somewhat interfered with by political excitements. A few manufacturing shares are better, Castner-Kellners being ½ higher, and British Westinghouse Fours a point better.

Bank Rate.—The Bank Rate was yesterday reduced from 4 to 3½ per cent.

Metropolitan Railway Co.—The directors announce a dividend on the ordinary stock for the past half-year at the rate of 1 per cent. per annum, carrying forward about £6,000. The return on the whole of 1909 is 1 per cent., as compared with ½ per cent. for the previous 12 months.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.*	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Jan. 11th.	Closing Quotations Jan. 18th.	Business done week ended Jan. 18th, 1910. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3⅜ – 3¾	3⅜ – 3¾	..	..	..	Nil.
136,700	Do. do. 6 % Debs., Nos. 1 to 1,950 Red.	100	5 %	5 %	5 %	5 %	99 –102	99 - 102 xd	..	..	..	4 18 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	143 –145	141 –143	..	..	–2	5 11 11
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 – 96	94 – 96 xd	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	34%	34%	£3 4s.	..	60 – 62	60 – 62	60⅜	60½	..	5 8 4
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	..	99½–100½	100½–101½	101	100½	+ ½	5 18 3
3,220,770	Do. do. do. Deferred	Stock	1¾	1 %	8/-	..	2 ½– 2⅝	2⅛ – 2⅛	2⅛	2⅛	+ ⅛	1 16 5
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	..	101 –103	101 –103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅞ – 8¼	7⅞ – 8 xd	..	..	..	5 0 0
2,481,850	Commercial Cable, Sing. 500 year 4% Deb. St. Red.	Stock	4 %	4 %	4 %	4 %	85 – 87	86 – 88	87	86	+1	4 10 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	8½ – 9⅛	8½ – 9⅛	8½	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17 – 18	17 – 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 – 3¼	3 – 3¼	..	..	..	6 14 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	8 – 8½	8 – 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 –101	99 –101 xd	..	..	..	4 9 1
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	..	13 – 13½	13¼ – 14	13⅝	13⅜	+ ⅛	6 1 5
39,500‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	98 –100	98½ –100½	..	..	+ ½	4 9 7
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 –137	135 –136 xd	135	133⅜	..	5 2 11
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	85 – 87	84 – 86 xd	..	..	..	4 1 5
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	..	102 –104	102 –104	10½	..	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12 – 12½	12 – 12½ xd	12⅛	12⅛	..	5 12 0
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	102 –104	102 –104	103½	103½	..	3 16 11
900,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	99 –101	99 –101	..	..	..	3 19 3
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	..	10⅛– 10⅜	10⅛ – 10⅜	10⅛	10⅞	..	5 6 1
181,127	Do. do. 5 % Pref.	10	5 %	5 %	5 %	..	13½ – 13¾	13½ – 13¾	13⅝	..	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	20 %	18 %	..	29½ – 30½	30 – 31	30½	..	+ ½	5 16 2
5,000‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½ %	98 - 100	98½ -100½	..	..	+ ½	4 9 7
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	50½ – 52½	50½ – 52½	52½	52	..	7 2 10
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½ %	93 – 95	93 – 95	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 – 80	78 – 83	80½	..	+ 1½	4 18 5
804,180	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜– ⅝	⅜– ⅝	15/-	13/6	+ 3/	£61
72,880	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	⅝– ¾	⅝– ¾	..	..	+ 1/	6 8 0
66,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞– 1	⅞– 1	..	..	..	5 6 8
2,295,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	..	106½ 108	107 –108½	107⅞	107	+ ⅛	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	..	123 –125	123 –125	124	123	..	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	..	11½ – 11¾	10½ – 11½	..	..	+ ⅛	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	..	11 – 11	10½ – 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	..	5⅛ – 5⅜	5⅛ – 5⅛	5⅛	..	+ ⅛	4 7 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½ %	97 – 99	98 – 100	99½	98½	+1	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98½ -100½	99 –101	..	..	+ ½	3 19 3
179,818	Oriental Telep. and Elec. 1 to 171,604, fully paid ..	1	7 %	8 %	8 %	..	1⅜– 1½	1⅜ – 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	..	1 1/16– 1 1/16	1 1/16– 1 1/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 – 88	86 – 88 xd	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 - 100 xd	98 –100	..	..	..	4 0 0
11,889‡	Reuter's	8	5 %	5 %	5 %	..	7⅞ – 8⅛	⅞ – 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½ %	99 –101	99 –101 xd	..	..	..	4 9 1
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	129 –132	129 –132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ – 7⅛	6⅞ – 7⅛ xd	7⅜	7⅛	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛ – 5⅝	5⅛ – 5⅝ xd	..	..	— ⅛	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ – 1⅝	1⅜ – 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 –100	98 –100 xd	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13⅜ – 14⅛	13⅜ – 14⅛	14	13 13/16	+ ⅛	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 –103	101 –103 xd	..	..	..	3 17 8
88,891	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜ – ⅝	⅜ – ⅝	..	..	+ ⅛	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	..	8½ – 9¼	8½ – 9¼	..	..	— ⅛	6 11 6
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	16 %	..	8 – 9	8 – 9	..	..	..	6 18 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 –102	100 –102 xd	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅞– 4¼	4⅞– 4¼	90 7½	88/9	..	5 5 1
500,000	Do. 5 % 2nd Pref., 500,001 to 1,000,000	5	..	..	..	..	4¼– 4½	4⅛ – 4⅛	..	..	— ⅛	5 11 1
978,230	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ – 92	90½ – 92 xd	91½	90⅞	..	4 7 0
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 –105	102 –105 xd	..	..	..	4 15 8
550,000	Babcock & Wilcox, 1 to 550,000	1	20 %	20 %	20 %	..	4⅜– 4⅝	4⅜– 4⅝	95/-	94/1½	..	4 8 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 1/16– 1 1/16	1 1/16– 1 1/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	⅜– ½	⅜– ½	15/-	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	1½ – 1⅝	1½ – 1⅝	..	..	..	10 0 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	3¼ – 3⅜	3¼ – 3⅜	..	..	..	8 5 6
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	2⅜ – 3¼	2⅜ – 3⅛	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	..	97 –100	97 –100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	..	142 –146	141 –145	..	..	— 1	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	121 –125	121 –125	123½	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	6 %	6 %	..	110 –113	108 –111 xd	111½	108½	..	4 10 1
333,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	..	102 –104	102 –104	..	..	..	4 5 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	..	102 –105	100 –103 xd	104½	102½	..	4 7 5
188,801	British Electric Traction	10	Nil	Nil	Nil	..	⅜– 1	1⅛– 1⅜	£0/-	23/9	+ ⅜	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	..	2⅝ – 3	3⅜ – 4	78/9	68/9	+1	3 15 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	84 – 87	87 – 90	87	86½	+3	5 11 1
598,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	60 – 65	65 – 69	£6	..	+4½	7 10 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	..	7 – 7¼	7⅛ – 7⅜	..	..	+ 1/16	5 10 5
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6¼ – 6⅝	6⅛ – 6⅜	..	..	..	6 11 2
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	..	101 –104	101 –104	..	..	..	4 6 7
904,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 – 94	89 – 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 300,000 and 375,001 to 375,000	5	Nil	Nil	Nil	..	⅛– ⅜	⅛– ⅜	..	..	..	Nil
1,816,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	46 – 50	46 – 50 xd	50½	..	..	8 0 0
50,000	Brownett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1/16– 1/8	1/16– 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	15/6 to 15/6	15/9 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	0 – ⅛	0 – ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 – ⅛	0 – ⅛	..	..	..	Nil
126,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	41 – 46	41 – 46	41½	..	..	9 15 8
126,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	25 – 29	25 – 29	..	..	..	15 3 0
187,510	Calcutta Trams, 1 to 187,510	5	8 %	6 %	4½%	..	4⅜ – 5	4⅜ – 5	5/6	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 20,220..	5	5 %	5 %	5 %	..	4⅛ – 4⅞	4⅛ – 4⅞ xd	..	..	..	5 2 7
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 –102	99 –102 xd	..	..	..	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10 – 10⅜	10 – 10⅜	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ – 5⅜	5⅛ – 5⅜	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½–104½	102½–104½	..	..	..	4 6 2
491,229	Cape E. Trams., 1 to 491,229	1	Nil	Nil	Nil	..	1/16– 1/8	1/16– 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅜ – 2½	2⅜ – 2½	49/3	47/3	+ ⅛	5 0 0
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	..	105 –108	105 –108	..	..	..	3 14 1
1,990 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	..	67 – 69	66 – 68	68	66½	—1	4 15 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	..	86 – 88	86 – 88	87½	..	..	4 10 11
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	..	48 – 50	48 – 50	..	..	..	5 0 0
1,480,000	City and South London Railway	Stock	2½%	2½%	1¼%	..	33 – 34	33½ – 33¾	33½	33	— ½	4 9 7
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜– ⅝	⅜– ⅝	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 1,000 of £50 Red		5 %	5 %	5 %	5 %	88 – 91	88 – 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations Jan. 11th.	Closing Quotations Jan. 18th.	Business done week ended Jan. 18th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	1 — 1¼	1 — 1¼	..	..	..	6 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	5 9 1
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —100	98 — 101	..	..	+ ½	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	..	12⅝— 13⅜	12⅝— 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	2½%	Nil	..	⅝— ¾	⅝— ¾	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	2½%	Nil	..	⅝— 1⅛	1 — 1¼	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	64 — 69	64 — 69	..	..	..	5 15 11
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅝— ¾	⅝— ¾	10/-	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	..	1⅛— 1⅛	1⅛— 1⅛	..	..	..	10 4 0
95,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7⅞— 8⅛	7⅞— 8⅛	..	..	..	6 1 8
210,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	..	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½%	Nil	..	⅝— ¾	⅝— ¾	..	..	..	Nil
98,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½— 10¾	10½— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 — 103	..	..	..	4 .6 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	..	12 — 12⅝	12 — 12⅝	12⅝	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5 — 5⅛	5 — 5⅛	5 1/16	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10 %	10 %	10 %	..	15 — 15⅝	15 — 15⅝	15 9/16	..	..	6 7 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	..	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	Nil	..	1½— 2⅛	1½— 2⅛	..	..	..	Nil
299,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½— 2⅛	1½— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125 000	10	5 %	5 %	3½%	..	1¾ — 2⅛	1¾ — 2⅛	£8/1½	..	+ ⅛	16 15 10
1,649,280	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	58 — 63 xd	60 — 65	62	61½	+2	6 3 1
5,733,062	Metropolitan Consolidated	100	1 %	½%	½%	1 %	40 — 40½	39½ — 39¾	40¾	39½	— ¾	2 10 4
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	..	66 — 68	66 — 68	67½	66½	..	4 0 11
3,295,000	Do. District	100	Nil	Nil	Nil	..	17⅞— 18½	17⅞— 18	18	..	— ½	Nil
801,327	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	⅝— ¾	⅝— ¾	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	..	⅝— ¾	⅝— ¾	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	..	¾— ⅞	¾— ⅞	16/3	16/-	+ 1/16	5 14 3
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½—126½	125 —127	126	125⅝	+ ⅛	
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	92 — 94	92½ — 94½	94	92½	+ ½	5 5 10
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅛— ¼	⅛— ¼	..	..	..	
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	½— ⅝	½— ⅝	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	84 — 87	84 — 87	..	..	..	5 3 6
97,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	..	34½ — 36	34½ — 36	..	..	..	5 8 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	100½—101½	101 —102	101½	100½	+ ½	4 18 0
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	..	87 — 89	87 — 89	89½	87¼	..	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	34 — 36	34 — 36	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	..	⅛— ¼	⅛— ¼	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	6	..	6 %	6 %	..	1½ — 2½	1½ — 2½	40/-	35/-	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	..	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	..	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,000	5	10%	10 %	10 %	..	7⅛— 7⅜	7⅛— 7⅜	7⅛	..	..	6 1 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7⅛— 7⅜	7⅛— 7⅜	..	..	..	4 4 10
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	..	4 — 4½	4 — 4½	82/6	..	— ½	5 11 1
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4½— 4⅝	4½— 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	..	8¾— 9	8¾— 9	77/6	..	..	5 0 0
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	8½— 8⅝	8½— 8⅝	70/-	..	+ ⅛	6 0 0
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	..	98 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	..	10½— 10⅝	10½— 10⅝	..	..	..	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	12 — 13	12 — 13	12⅛	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	2 %	2 %	..	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	..	3⅜— 3⅝	3⅜— 3⅝	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	91 — 93	91 — 93	..	..	..	5 7 6
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8	7⅞— 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅝— 11⅛	10⅝— 11⅛	10⅝	10⅜	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	105⅛	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	..	98 —101	98 —101	100⅜	99½	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
60,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	57 — 60	55 — 58 xd	..	..	..	7 10 0
$8,160,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	89 — 92	81 — 84	83½	83	— 7/8	5 19 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to10,000	5	5 %	5 %	5 %	..	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	..	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	101 —103	101⅛—103⅛	103⅛	102	+ ⅛	4 16 7
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	..	7 — 7⅛	7 — 7⅛	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅞— 2⅛	1⅞— 2⅛	..	..	..	4 4 3
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	..	4⅜— 5⅛	4⅜— 5⅛	90/4½	..	..	6 0 0
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	90 — 93	90 — 93	..	..	..	4 6 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	..	4 — 4½	4 — 4½	83/1½	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4⅜— 5	4⅜— 5 xd	..	..	..	4 10 0
225,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107 xd	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	88 — 87	83 — 86 xd	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	77 — 81	80 — 82	81	80½	+2	6 1 11
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½%	..	68 — 70	67½— 69½ xd	68½	68	..	5 0 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	..	100 —104	100 —104	102	101	..	6 14 7
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	100	..	..	5 %	..	85 — 90	88 — 90	89½	88 1/16	..	5 11 1
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 187,500	5	3 %	3 %	2½%	..	3⅜— 4⅛	3⅜— 4⅜	..	..	+ ⅛	2 17 1
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	..	3⅜— 4⅛	3⅜— 4⅜	..	..	+ ⅛	5 14 8
196,500	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,965}	100	..	..	..	5 %	99 — 101	99 —101	..	..	..	4 19 0
16,853	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12½— 13½	12½— 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	..	..	6 — 6⅝	6 — 6⅝	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	..	95 — 98	95 — 96 xd	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	2½%	6 %	3 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 18 6
100,000	Do. do. 8% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	101 —104	101 —104 xd	..	..	..	4 16 2
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	10 %	10 %	10 %	..	8¾— 9	8¾— 9	..	..	..	6 7 0
70,000‡	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	..	7 — 7⅛	7 — 7⅛	..	..	..	5 11 1
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	83 — 87	83 — 87 xd	..	..	..	4 0 6
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	½— 2	1½— 2	37/6	..	..	Nil
85,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	..	2⅜— 2½	2⅜— 2⅝	..	..	..	9 6 1
150,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	..	..	100 —108	..	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅝— ¾	⅝— ¾	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1⅛— 1⅜	1⅛— 1⅜	23/1½	..	..	5 17 11
284,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	74⅛— 78⅛	74⅛— 78⅛	..	..	..	5 14 8
608,000	Victoria Falls Power Co., Pref. Nos. 1 to 608,000 ..	1	..	..	5 %	..	⅝— ¾	⅝— ¾	..	..	..	5 6 8
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	..	8⅜— 9⅛	8⅜— 9⅛	8½	..	..	5 9 7
61,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	..	5⅛— 5⅜	5 — 5⅛ xd	..	..	..	4 0 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4% per cent., January 6th, 1910.

THE MANUFACTURE AND TESTING OF RUBBER GAUNTLETS.

By J. LUSTGARTEN.

In handling live high-tension gear, immunity against fatal shocks must be secured; the safety of the operator can be obtained by thoroughly insulating him from the ground and by preventing his simultaneous contact with two live mains or his too close proximity to the latter.

Thick rubber matting or wooden platforms on suitable insulators provide a means of insulating the operator from earth. These must be of sufficient dielectric strength to withstand puncture with from twice to four times the working voltage of the high-tension apparatus in use. As an extra precaution rubber boots or gauntlets, or both, are employed. Gauntlets especially are used in the handling of live cables and wires, and these are sometimes leather covered or are used in conjunction with a leather or knitted outer glove to guard against tearing of the rubber glove and so increase the safety of the operator. The leather gauntlet is often specially made for this class of work, the joints and all sewn parts being protected with rubber. The knitted glove also has rubber strips fastened sometimes obliquely so as to cover the back as well as the palm of the glove; the fingers are also strengthened. Another form of outer glove is made of knitted silk or hemp, the joints of which may or may not be rubber covered.

In this country Messrs. David Moseley & Sons, amongst others, manufacture special rubber gloves and gauntlets for handling live wires, &c.

Great care is taken in the manufacture of these gloves, and the process—carried out by females who have received many years' training in this particular work—is exceedingly interesting.

From cylindrical blocks of the finest pure Para rubber, weighing about 4 cwt. and made under enormous pressure, the sheet for the gloves is cut into the required thickness. The cylindrical block has a spindle in its centre, enabling it to be rotated and to feed the rubber forward to an oscillating knife. After being allowed to stand for several days, the sheet is subjected to a roasting for a considerable length of time on a chest heated to a fairly high temperature, and then on cooling down the several parts of the glove are cut out, the cutting-out process being carried out with great precaution.

Fig. 1 shows the component parts, *a*, *b*, *c* and *f*, which have been thus cut out; *c* is double. The strips *d*, *e* and *g* are of special adhesive rubber; *d* is intended to give a finished appearance to and to strengthen the small lap joint of the fingers and the side of the hand remote from the thumb; *e* strengthens the small lap joint of the thumb and the side of the hand below the thumb; *g* are merely the strips for the back of the hand, placed there in deference to the fashion obtaining with ordinary gloves. The strips further strengthen the gaps between the fingers.

The component parts of the glove are then given a further roasting for some considerable time at a high temperature, and after being placed together are worked very carefully while hot, so as to cohere at the joints, which when well made are practically seamless. The seams are now covered over with a very thin strip of rubber as a protection; this is not absolutely necessary, but it gives the glove, as previously stated, a finished appearance. We shall see later that the results of tests on small lap joints show that this is unnecessary from the point of view of strength.

The gloves are now subjected to the most important process of all, viz., vulcanisation. This is a secret process, and—as the gloves have to withstand various climatic conditions existing in different parts of the world—is so severe that only absolutely pure Para rubber can stand it. After this process the gloves are cleaned and purified, and after drying they are closely examined for the slightest fault before being subjected to the electrical tests.

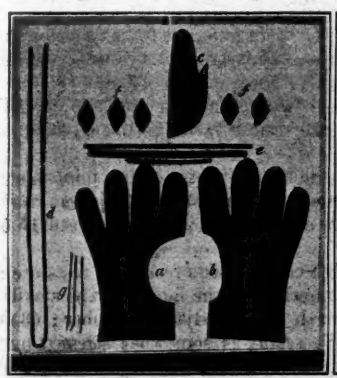
The tests are two-fold: (1) The insulation resistance test; (2) the electric strength or puncture test. The first test determines the leakage current and discloses any incipient fault, such as a bad joint or a very weak spot in the rubber. If such a fault is found, the electric strength test is not proceeded with.

The insulation test can be conducted either "dry" or "wet." In the dry test, the glove is filled with mercury to within 1 in. to 2 in. of the edge and immersed in mercury so that the levels of the outside and inside mercury are the same. In the wet test, the glove is filled with water to the same height as in the dry test, and is immersed in water. An alternative way is to fill the glove with very fine sand ("silver" sand) impregnated with ammonium chloride solution and embedded in similarly treated sand to the same height. The pressure for both the wet and dry tests should be above 100 volts (direct current) and preferably about 500 volts. On testing a gauntlet of pure Para rubber, 115 mils thick, by means of the wet (water) test with 500 volts (direct current) the insulation resistance was 21,500 megohms. Another gauntlet of the same thickness had a resistance even higher than the above, as no deflection of a very sensitive galvanometer could be obtained. An inferior rubber of the same thickness would give a less resistance.

The second test consists of subjecting the rubber glove to a high alternating-current pressure of a value depending on the normal working pressure of the apparatus to be handled.

Water or wet sand is used for the electrodes. In fig. 2 a testing tank is shown with gauntlets filled with water to 1½ in. from the top and immersed in water. Care must be taken that moisture does not bridge across the gauntlet from the inner to the outer mass of water, otherwise sparking will take place when the pressure is put on. A little moisture does not matter, as the small brush discharge set up will quickly dry it.

To support the gauntlet and to keep it erect, two small clips are attached to opposite sides of the rim of the glove, and a piece of string is attached to these and looped over a glass or wooden rod. Wires are inserted in the outside and inside masses of water and connected in series with choke coils to the testing transformer, one terminal of which—that



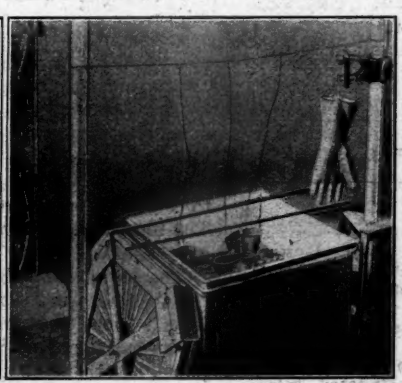


Fig. 1.—Component Parts of Gauntlet. Fig. 2.—Testing Tank for Gauntlets.

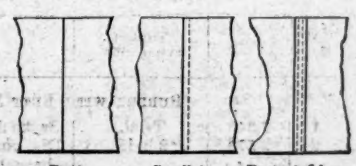


Fig. 3.

connected to the outside mass of water—is preferably grounded. The function of the choke coils is to limit the current should the glove be pierced. A choke coil is shown in fig. 2 at the side of the tank. The circuit being closed, the pressure is brought up gradually from about half the value specified to the full amount; the duration of time occupied should be about a minute. The pressure is then held on for an interval of time, as suggested in the table below, and then reduced to half the specified value, when the circuit is broken, the reduction occupying about 5 seconds.

Table of Suggested Testing Pressures.

Normal pressure of apparatus to be handled. (Alternating current.)	Testing pressure. (Alternating current.)	Duration of time.	Remarks.
100 to 3,000 volts	Double the normal pressure, but not less than 2,000 volts; or	1 minute	
	Double the normal pressure plus 1,000 volts, but not less than 3,000 volts.	10 seconds	
Above 3,000 to 7,000 volts	Double the normal pressure, but not greater than 8,000 volts; or	1 minute	The gauntlets must be used with the auxiliary rubber boots or mat or other insulating stand.
	Double the normal pressure plus 1,000 volts, but not greater than 9,000 volts.	10 seconds	

It is not advisable to use gauntlets alone for voltages above 3,000 volts. Rubber boots, rubber mats or other insulated platforms should be employed for extra insulation. The highest pressure, which should be handled with gauntlets together with boots as an extra safeguard, is 7,000 volts. The gauntlets should be tested with 8,000 volts for 1 minute and the rubber boots or mat with double the normal pressure for the same period.

By multiplying the first column in the table by 1·4, we shall get the direct-current voltages of apparatus to be handled, to which the figures in the second column—the testing pressures—correspond.

A series of tests were made on three kinds of rubber joints, viz.: (1) a butt, (2) a small lap, and (3) a protected lap, in order to find their relative electric strengths. They were each made from the same sheet rubber (95 mils thick) specially manufactured for gloves, and the results are given in the table below.

Table of Puncture Voltages.

Test No.	Volts.	Time of application.	Remarks.
		Rubber with Butt Joint.	
1	7,340	Trial.	Broke down in seam.
2	3,570	2 min.	Did not break down. Pressure brought up 500 volts in 2-minute stages to 13,000.
	13,000	1 min. 50 sec.	Broke down in seam.
3	6,730	Volts brought up gradually.	Broke down in seam.
4	12,700	" "	Broke down in seam. This part was slightly stretched before test to note effect on breakdown volts.
5	6,520	" "	Broke down in seam.
6	5,200	2 min.	Did not break down. Pressure then increased by 900 volts in 2-minute stages to 7,650.
	7,650	" "	Broke down in seam.
7	13,210	—	Broke down in rubber at edge of electrode. *This was a test on the rubber sheet away from the seam.*
		Rubber with Small Lap Joint.	
8	10,200	5 min.	Did not break down. Pressure raised every 2 minutes by 600 volts to 13,700.
	13,700	—	Broke down in seam.
9	12,950	10 min.	Did not break down.
	13,300	1 min. 33 sec.	Broke down in seam.
10	10,700	4 min.	Broke down in rubber adjacent to seam.
11	9,300	2 min.	Broke down in seam.
12	9,400	4 min.	Broke down in rubber adjacent to seam.
	9,800	1 min. 45 sec.	
13	10,250	4 min.	Did not break down. Pressure raised every 3 minutes by 500-volt stages to 19,500.
	19,500	1½ min.	Broke down in rubber at edge of electrode. *This was a test on the rubber sheet away from the seam.*
14	14,060	1½ min.	Did not break down.
	15,200	1½ "	" " "
	16,100	2½ "	" " "
	20,400	—	Broke down ¼ in. from electrode towards the seam side. Similar test to No. 13.
15	19,500	—	Broke down ¼ in. from electrode towards seam. Similar test to No. 13.
16	20,400	—	Flashed to previous puncture.
17	15,500	—	Broke down. Similar test to No. 13, but on rubber on opposite side of seam.
18	14,600	—	Broke down. Same as No. 17.
		Rubber with Protected Small Lap Joints.	
19	12,500	2 min.	Did not break down. Pressure brought up very gradually in 5-minute stages to 19,100.
	19,100	—	Broke down in rubber ¼ in. from seam.
20	17,200	—	Flashed over.
	17,700	—	Broke down in seam.
21	18,600	—	Broke down in rubber at edge of electrode. *This was a test on rubber away from seam.*
22	16,000	—	Broke down. Similar test to No. 21.
23	15,500	—	Broke down. Similar test to No. 21, but on rubber on opposite side of seam.

From tests 1, 3, 5 and 6 the butt joint has an average breakdown pressure of 7,000 volts. The rubber in test 7 has a breakdown voltage of 13,200. It will be noticed that in two places (tests 2 and 4) the joint is almost as good as the rubber.

The small lap joint, from tests 8 and 9, has a breakdown voltage of about 13,500, and therefore of almost the same value as that of the rubber sheet in tests 17 and 18. Tests 10, 11 and 12 disclose weak spots in the rubber. The breakdown voltage of the rubber varies between 14,600 and 20,000.

The breakdown voltage of the protected lap joint is equal to (if not actually greater than) that of the adjacent rubber. The breakdown voltage of the rubber varies between 15,500 and 19,000.

The deductions which can be made from the tests are:—(1) the butt joint is inferior to the lap; (2) the small lap joint is equal in strength to the adjacent rubber; (3) the rubber adjacent to the seams is somewhat stressed by the joints, and therefore has a lower breakdown voltage than the rubber away from the joints.

A series of tests were made on rubber mats of different thicknesses having about 17 per cent. pure Para rubber in their composition. As the upper surface of each mat was corrugated, tin-foil was used for electrodes, and weighted brass plates covered the tin-foil. The alternating-current pressure was brought up gradually and held on for certain time intervals, as indicated in the table of results. In the case of the first mat tested (1/16 in. thick), the heat developed between the electrodes raised two large blisters, one on either side of the mat, which eventually threw off the brass plate electrodes. These were then removed, the tin-foil being used alone, and in the subsequent tests on other mats unweighted electrodes were employed. Considerable brush and spark discharges in air contiguous to the electrodes occurred on the surfaces of the mats, and these had the effect of producing ozone which blackened the surface of the rubber. The ozone produced will, in a prolonged time test on the rubber mat, together with the chief factor—the heating of the rubber—cause its ultimate breakdown.

TABLE OF PUNCTURE VOLTAGES ON RUBBER MATS.

Thickness of mat.	Test No.	Volts.	Time of application.	Remarks.
$\frac{1}{16}$ in.	1	55,500—57,700	20 min.	Did not break down.
		58,500	5 "	" "
		60,600	20 "	" "
		63,600	10 "	" "
		67,700	15½ "	Electrode was thrown off. Two blisters formed on either side of rubber. On bringing pressure up, rubber broke down. Internal cracking must have occurred, on cooling, during interval before electrodes were replaced.
$\frac{1}{16}$ in. (a second sheet of same material)	2	64,460	5 "	Did not break down.
		67,700	10 "	" "
		69,360	10 "	" "
		70,980	10 "	Flashed over several times, reduced voltage to 69,360.
		69,360	29 min. 50 sec.	Broke down in a groove at edge of tin-foil electrode. Even at this voltage, flashing over took place several times.
$\frac{7}{128}$ in.	3	55,080	5 min.	Did not break down.
		57,520	5 "	" "
		57,920	5 "	" "
		61,200	15 "	" "
		64,460	2 "	Broke down, underneath tin-foil electrode.
$\frac{3}{8}$ in.	4	28,530	15 "	Did not break down.
		32,610	15 "	" "
		34,680	15 "	" "
		35,480	15 "	" "
		36,700	5 "	Did not break down. Went up in 2,000-volt stages every 5 min. until 52,000.
		52,000	10 "	Did not break down.
		54,560	2 "	Broke down in a groove at edge of electrode.
	5	53,500	Trial.	Flashed over.
		49,600	15 min.	Did not break down.
		50,180	19 "	" "
		51,400	22 "	Broke down underneath tin-foil. Flashed over several times before breaking down.

THE CALCULATOR-BOARD AS A CALIBRATOR OF THE RYMER-JONES DIRECT-READING D.R. GALVANOMETER SCALE.

NOTE FOR SUBMARINE CABLE STAFFS.

BY E. RAYMOND-BARKER.

THIS calculator-board method suggested itself to the writer when he was called upon to put into practice an idea conceived by Mr. J. Rymer-Jones, to construct, for use during the construction and testing of electrical condensers, scales on which dielectric resistances could be read off direct in megohms.

It became a question, then, to make and calibrate by means of the calculator-board, a galvanometer-scale from which dielectric resistances might be read off direct, the said resistances being between any desired lower and higher limits of, say, respectively, 200Ω and 12,000Ω, where a deflection from *zero* to the thousandth of 1,000 ordinary divisions of scale represents a resistance equivalent to the lower of the above-mentioned D R values, viz., 200 megohms.

This special calibration of the scale of a sensitive reflecting galvanometer is very easily effected with the calculator board and its sheet of millimetre sectional or squared paper 500 mm. × 500 mm. (approx.). The 1,000-division scale may conveniently be two divisions to the millimetre, the total length of the 1,000-division galvanometer scale being therefore 500 mm., or ½ metre.

From the knowledge that a deflection, D, of 1,000 divisions is to be taken as representing a dielectric resistance of 200Ω, R, it is easy to calculate by inverse proportion what would be the dielectric resistance, x, equivalent to various deflections, d, along the 1,000-division graduated scale, battery and shunt conditions remaining constant.

200Ω is given as a round number, but any other value obtained by experiment with the actual reflecting galvanometer and scale to be used may equally well be taken as basis of calculation.

A certain number of x's may be worked out and plotted on the millimetre squared paper.

The plottings will be found to be on the line of a curve, the ordinates of which are scale divisions and the abscissæ megohms.

Horizontal lines laid out from the several dielectric resistance plottings for x, and extended as far as the 1,000-division graduated scale A (in fig. 1), will severally indicate

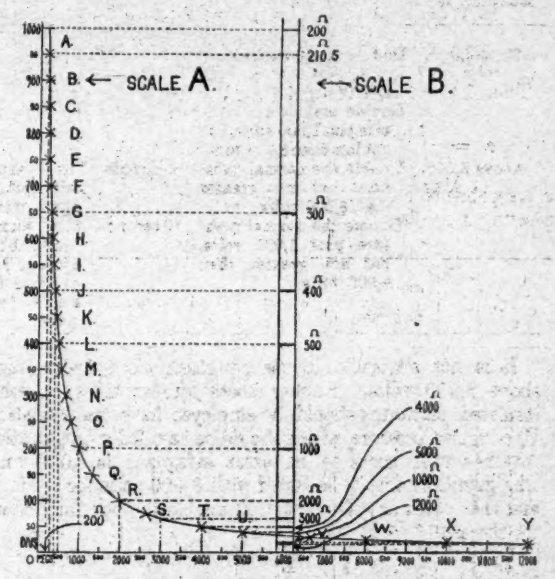


FIG. 1.

points or positions on the scale B (in fig. 1) corresponding to the various x resistances.

The said points may then be severally marked by calibrating lines and inscribed with their values in megohms, so that any deflection of the galvanometer *spot* may be read off *direct* in megohms.

Any required number of intermediate D R's may be measured off from the above-mentioned curve, and marked off with calibration lines and figures in megohms on the 1,000-division scale.

Mr. J. Rymer-Jones has pointed out a useful device by which the two scales—viz., A, the ordinary scale of 1,000 equal divisions, *zero* to 1,000, and B, the calibrated megohm direct-reading scale—are parallel to each other on the same strip of white cardboard, or other convenient material. The lens hair-line shadow across the luminous *spot* reflected from the galvanometer mirror may be easily made to extend vertically over both the above-mentioned graduations of the horizontal cardboard strip: this most convenient arrangement permitting either of the two scales to be used at pleasure.

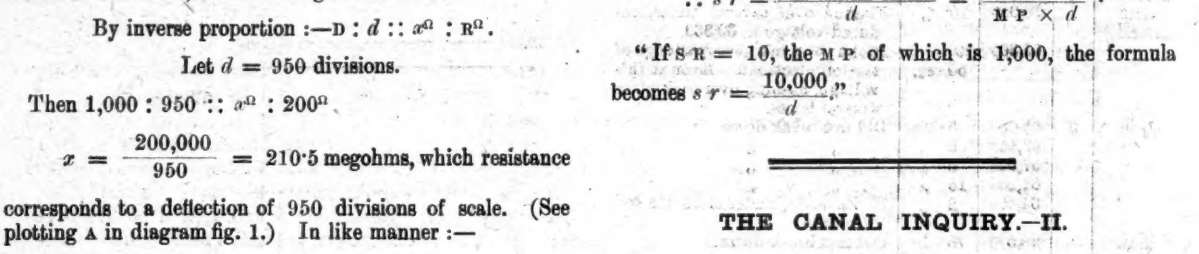
It is easy to imagine a further development of scale direct D R reading calibration at cable stations, where, for the routine D R tests on the cables, special scales might be constructed; one for each cable, with given battery and galvanometer-shunt conditions.

The scale *for a particular cable* would be calibrated not only in terms of *absolute* D R's between any convenient limits, but room might be found on the scale for an extra line of figures in terms of megohms *per nautical mile*.

In the same way a series of scales might be made and calibrated for the weekly routine D R tests made on the cases of A.L. forming the artificial cable for duplex working, the said calibration being not only in terms of megohms *absolute*, as on the Rymer-Jones scale, but in terms of megohms per microfarad.

With each one of the various sets of scales severally suited to the different cables or boxes of A.L., marked off on a slip of white cardboard, any cardboard slip required might be easily and expeditiously placed in position, and secured by clips on a brass or wooden frame or stand.

$S\,R = \frac{10{,}000}{M\,P}$ [where M P is the multiplying power of S R]—



DIRECT-READING GALVANOMETER SCALE

FIG. 2.

To proceed, then, with the special direct D R reading calibration of the 1,000-division galvanometer scale—

By inverse proportion :—$D : d :: x^{\Omega} : R^{\Omega}$.

Let $d = 950$ divisions.

Then $1{,}000 : 950 :: x^{\Omega} : 200^{\Omega}$.

$$x = \frac{200{,}000}{950} = 210{\cdot}5 \text{ megohms, which resistance}$$

corresponds to a deflection of 950 divisions of scale. (See plotting A in diagram fig. 1.) In like manner :—

Ordinary scale divs. divided into 200,000.	Equivalent D R, in megohms.	Plotting :—	Plotting conditions :—
900	222·2	B	
850	235·3	C	*Ordinates* :—
800	250·0	D	500 mm. = 1,000 divs., or
750	266·7	E	1 mm. = 2 divs.
700	285·7	F	
650	307·7	G	*Abscissæ* :—
600	333·3	H	40 mm. = 1,000 megohms, or
550	363·6	I	1 mm. = 25 megohms
500	400·0	J	480 mm. = 12,000 megohms
450	444·4	K	
400	500·0	L	
350	571·4	M	
300	666·6	N	
250	800·0	O	
200	1,000	P	
150	1,333	Q	
100	2,000	R	
75	2,667	S	
50	4,000	T	
40	5,000	U	
30	6,666	V	
25	8,000	W	
20	10,000	X	
16·667*	12,000	Y	
12·5	16,000	Z†	

* Calculated. † Not shown.

The foregoing particulars show how by means of the calculator-board the afore-mentioned 200Ω-12,000Ω scale, and various other Rymer-Jones scales for use within other limiting D R's, were made by the writer before the publication, by Mr. J. Rymer-Jones, of his most useful and instructive article in the ELECTRICAL REVIEW of January 10th, 1908. In the said article the 200Ω-12,000Ω scale (reduced in size) is shown completed. This same reduced scale is here reproduced in fig. 2 as a completed specimen of work effected by the method indicated in fig. 1, in which a sufficient number of D R calibrations are given to illustrate procedure.

Regarding preliminary adjustments, the following note by Mr. J. Rymer-Jones will be found useful :—

"As the universal shunt is not always sufficiently subdivided to give exactly the full scale deflection (1,000 divs.) with the testing battery through 1 megohm, the shunt required to give 1,000 divs. is calculated as follows :—

"Suppose when taking the *constant* the battery current through 1 megohm gives, with a slide reading S R, a deflection of d divs.; then, because the deflection is in direct proportion to the slide reading, the shunt $s\,r$ to give 1,000 divs. $= \frac{1{,}000\,S\,R}{d}$; and since the slide reading

$$\therefore s\,r = \frac{1{,}000 \times \frac{10{,}000}{M\,P}}{d} = \frac{10{,}000{,}000}{M\,P \times d}.$$

"If S R = 10, the M P of which is 1,000, the formula becomes $s\,r = \frac{10{,}000}{d}$."

THE CANAL INQUIRY.—II.

IN the beginning of railways it was not unnaturally supposed that the competition between them and the canals would have a chastening effect on the rates charged by either; and so it had—in the beginning. As time went on railways gradually covered the land with such a close network of lines that every town of any present or prospective importance was adequately served. The canals, on the other hand, cannot be said to have marched with the times and, as a natural consequence and in spite of friendly legislation, on only a few waterways or parts of waterways, favoured by special conditions combined, in two or three cases, with enterprising management, traffic was and has been maintained and even increased; on other waterways it declined, on some it has virtually disappeared. Everywhere the proportion of long-distance traffic to local traffic by water has become small.

The position of the canals, so far as regards their total traffic, has been at best one of a stationary character since the development of steam traction on railroads and on the sea, while the whole transport business of the country has multiplied itself several times over. During this period the facilities given on what may be called estuaries were enormously increased and ocean liners penetrated further and further inland, while the harbours served by coasting vessels were also enlarged, deepened, and made more secure.

As is the case in most decaying industries, the canals did not take kindly to this threatened extinction and kept on calling on the State to help them out of a state of affairs due entirely to inherent defects in their systems and to a change in the working of all traffic due to changed conditions of trade. These changes are well described in the Report, but the Government from time to time were constrained to listen to the voice of those who did not appreciate or understand these changes. Between 1892 and 1895 some inquiries into the condition of certain waterways were made by the Board of Trade. In 1900 the Associated Chambers of Commerce clamoured for a Royal Commission to consider the whole question, but this request was not granted till six years later when the present Commission was appointed, on a further demand by the Associated Chambers of Commerce, with instructions thus summarised:—"Taking the waterways of the United Kingdom as they are at present, will it benefit the trade of the country, and is it practicable, at a cost compatible with a reasonable return, to effect such improvements as shall make them more desirable to the requirements of modern commerce and, if so, in what way and by whom should this be done?"

A Select Committee had been appointed in 1846 (the Railway Commission having been formed in that year) to inquire into the principles upon which amalgamation of canal companies and of these with railway companies should be allowed, when they were clearly proved to be without prejudice to public interests—and 774 miles of canals fell

partly or wholly under railway control. In 1872 a Joint Select Committee of both Houses inquired into the whole question of amalgamation, and still harped on the competition string, and reported that it was important an effort should be made to maintain the competition that existed, though it was then evidently in a bad way; but that it was still more important, whether competition was maintained or not, that the capacities of inland navigation should be fully utilised and developed. The Railway and Canal Traffic Act of 1873 followed, one of the sections of which was aimed against such an arrangement as that by which the Birmingham Waterways had come under the control of the London and North-Western Railway Co.

This arrangement, however, resulted in great advantages to the waterways; in the words of the present Commission:—"It is, we think, unlikely that the Birmingham Canal Co. had it not been, since 1876, under the control, and supported by the financial resources, of the London and North-Western Railway Co., would have spent as much on maintaining and improving the canal as has actually been spent during that period." The Joint Committee was a strong one, stronger, it may be said without offence, than the present one, for on it sat Lord Carlingford, as chairman; Lords Ripon, Salisbury, Derby, Cowper, Ridesdale, Monk Bretton, and Cross; with Messrs. Cave, Childers, Dodson, Hunt and Ward.

A Select Committee of the House of Commons sat in 1881 and 1882 on the subject of railway and canal charges and on the working of the Railway Commission; they found that there was some foundation for the complaints that had been made against the treatment of canals by railways, and they recommended that Parliament should not sanction any further control, direct or indirect, of canal navigation by a railway company. The railway companies probably received this blow with great equanimity. In 1883 another similar Select Committee inquired into the condition and position of the canals and internal navigation of the country, and added another volume of goodly size to the extensive literature that had already accumulated. They advised their re-appointment, which, however, did not take place.

The last piece of legislative activity recorded is the Railway and Canal Traffic Act of 1888, by which considerable additions were made to the powers exercised by the Board of Trade with regard to canals; there were also other important changes, such as substituting the present Railway and Canal Commission for the Railway Commissioners, and dealing with traffic on both systems. By the Act decennial returns were called for, inspections were made, and the abandonment of derelict canals was sanctioned. Sir William Holland had introduced Bills formulating the demands of the Chambers of Commerce in 1901, 1905 and 1906, the latter being before Parliament when the present Commission was appointed.

The names of the members who dissented, more or less, from the Majority Report have already been given; the majority was composed of the following gentlemen:—Chairman, Lord Shuttleworth, better known as Sir Ughtred Kay-Shuttleworth, a Liberal M.P. and author of "Quo Vadis," who has been a member of the London School Board, Under-Secretary at the India Office, Secretary to the Admiralty, and chairman of the Public Accounts Committee; Baron Kenyon, who retired on his election to the board of the L. & N.W.R. Co.; Lord Brassey, G.C.B., Assoc.Inst.C.E.; Sir John E. Dorington, Bart., a former Conservative M.P., a great archæologist and county magnate, chairman of the Committee on Ordnance Surveys and a member of the Commission on London Water Supply; Sir John T. Brunner, Bart., LLD., Liberal M.P., chairman of Brunner, Mond & Co.; Sir William J. Crossley, Bart., Liberal M.P., of Messrs. Crossley Bros., and a director, during the construction, of the Manchester Ship Canal Co.; Sir Francis Hopwood, G.C.M.G., K.C.B., a Liberal, formerly Permanent Secretary to the Board of Trade, and now Permanent Under-Secretary of State for the Colonies, as a result of the last Colonial Conference; Mr. Philip Snowden, Socialist M.P., who retired from the Civil Service in 1893, after seven years; Mr. Henry Vivian, Liberal M.P., who has risen from the ranks; Mr. J. P. Griffith, M.Inst.C.E. since 1888, who won a Miller prize in 1861, and whose practice has been mostly in Ireland; Mr. A. J. Henderson, M.A., Ph.D., Hon. Secretary Geographical Association and Professor of Geography at Oxford; Mr. M. J. Minch, formerly Nationalist M.P., vice-chairman of the Kildare County Council; and Mr. William H. Lindley, who has been M.Inst.C.E. since 1878. Mr. W. B. Duffield, M.A., the secretary, is a Liberal and a barrister, and Mr. R. B. Dunwoody, the assistant-secretary and engineer, is a former student, and was elected Assoc.M.Inst.C.E. about five years ago. Being thus composed, it is no wonder that the Majority Report leaned in the direction of railway nationalisation. The witnesses examined included both canal and railway men; canal authorities and carriers thereon, commercial men of sorts, agriculturists, mine-owners, "and other witnesses"; manufacturing and mining associations, Chambers of Commerce, County and City Councils, "&c.," engineers and other experts on questions of inland navigation. The list is comprehensive enough in all conscience!

A close study of the Report is both interesting and enlightening. The multiplicity of authorities is a great impediment to through traffic on the canals, as it is to tramway undertakings on the roads, and Mr. Davison agrees with the majority that this should be abolished, Mr. Inglis pointing out that between Birmingham and Hull a cargo would be returned by 10 different canal authorities, and that it is in this way that the traffic returns are unduly inflated.

Referring to the Report on the condition of the larger rivers, viz., the Thames, Severn, Avon, Trent, Ouse, Humber and Nene, Mr. Inglis draws attention to the decadence of the traffic on the magnificent natural waterways in the States, owing to the extra handling required as compared with railways, and, as he truly adds, the position becomes still more complicated should the rivers be obstructed by floods, frosts, low water, silting up, changes and windings of channels.

Seeing the magnificent results of the Manchester Ship Canal, and of the improvements to the Tyne and Clyde, as already mentioned, it would appear as if money spent on the larger rivers would be much more productive of good to the country at large than anything that could be done on the canals for the same amount of money. "When the average business man learns that in a dry season the river traffic between Hull and Newark may be delayed two or three weeks" (as stated in the Report) "owing to a shortage of water; or that it would take a barge on the Nene nearly three days to accomplish the journey from Northampton to Peterborough" (also in the Report) "which a locomotive will do in two hours, he will no longer be surprised that preference should be shown for the railways."

The inclined lift, to which allusion has already been made, and which was one of Mr. Taylor's recommendations, is at Foxton, on the Leicester branch of the Grand Junction Canal, and appears to be in amongst some 31 locks, while it has replaced a further set of locks. It is evident that the use of portages or inclines saves a great deal of water—an expensive article on summit levels, and often difficult to get in other places; it is not so evident why these appliances have not come into more general use in this country. Another expense to which some canals are liable is that due to subsidences, owing to underground workings. A notable instance is that of the Manchester, Bury and Bolton Canal, belonging to the Lancashire and Yorkshire Railway; it is only 16 miles in length, but in seven years the company had to spend £310,000 on works of maintenance owing to this cause. Altogether the Report is not very cheerful reading as regards the actual material condition of waterways in this country; the impediments to through traffic which are enumerated, must, many of them, also affect local transport. They are:—Differences in sectional area; size of locks; depth of channel and general condition; divided ownership; deteriorating condition and insufficient depth of channel.

One fact to be noted, which ought surely to have governed the Commission's recommendations, is that the important waterways extend to a portion only of England and Wales; why, therefore, should the public in general be made to contribute to the upkeep of a small proportion both in numbers and in miles of the waterways, viz., 984 miles out of 5,085 miles, which take 53 per cent. of the total tonnage, and should, therefore, be able to maintain and improve their own undertakings should it be worth while doing so? As it is, the Commission agrees that local rates fall mainly and unfairly on English waterways, as they also do on railways.

It seems curious, in this connection, that the theory of "unearned increment" has not been applied. It is considered iniquitous that private individuals should profit by the expenditure of public bodies to which they have contributed very little; surely the reverse is also true, that it is still more iniquitous that the country in general should profit by the expenditure of private individuals, to which they have contributed nothing whatever; especially as, instead of recouping them in part for such expenditure, they, the community or the State, actually tax them heavily for these same benefits. The recommendations of the Committee, if carried out, would make amends for this injustice in the case of a small proportion of the canals, but would thereby add to the burdens not only of the less favoured waterways, but of the railways. Railways are already taxed to pay for competing tramways, and now it is actually proposed to tax them further to enable some canals to compete with them under the most favourable conditions. And yet the Report is free to confess that "it is not just to say, as some have done, that railway companies, except, *perhaps* (our italics), in a few instances, acquired canals in order to strangle them." The Commissioners do not impute to the companies any positive and deliberate intention of throwing obstacles in the way of traffic on their canals, and yet the Majority Report recommends a policy which, if entirely successful, would deliberately throw obstacles in the way of traffic on the competing railways.

The recommendations of the majority in the Commission may now be summarised as briefly as possible:—

The first measure should be the formation of a Central Water Board for Great Britain on the lines of the "Road Board."

The four main routes forming the "cross" should be vested in the Board at once.

The Water Board to propose a scheme or schemes for submission to Parliament if approved by the Government and to continue doing so from time to time.

The acquisition of any British waterways of importance now in the hands of railway companies (whether worked to the best advantage or not), and including the Caledonian and Crinan Canals, should be included in one or more of the earlier schemes.

The collection of information as to flows of rivers and streams, and as to water supplies to navigable waterways, might also be entrusted to the Board.

The Board might be assisted by Local Advisory Committees. The necessary waterways should be acquired by a procedure resembling that adopted in the Port of London Act.

The total cost of the whole scheme of improvements (*excluding cost of acquisition*) is estimated to be 17½ millions by the majority, but Mr. Davison considers it would be much more, and it is to be borne partially or wholly, by the State. This expenditure would be spread over many years. The working expenses are estimated at over a million, while the existing gross income of the canals affected is £568,000.

It would really appear as if these many millions could be more advantageously applied, as already suggested, in improving and deepening existing tidal rivers, or to quote the President of the Institution of Civil Engineers, if the State desire to cheapen transport, they should do so, "by assisting that means of transportation which is available for all descriptions of traffic, can give a far more efficient service generally, and cannot be done without." This assistance might very well take the shape of remitting or lessening both the local and the State taxation of railways.

Self-Starter for Induction Motor.—According to the *Financial News*, a patent recently issued to Messrs. B. G. Lamme, R. S. Feicht and G. H. Gaulon, deals with means for rendering a single-phase induction motor self-starting under full-load torque. The rotor of the machine is arranged to revolve independently of the shaft during the starting period. The arrangement is such that the rotor starts from rest with the machine operating as a split-phase motor. As the speed increases, a centrifugal device first opens the auxiliary starting circuit, then short-circuits the added starting resistance in the secondary circuit, and finally clamps the rotor upon the shaft, thereby bringing the shaft with its load up to the full-load speed of the machine.

REVIEWS.

Die Transformatoren. By Dr. G. Benischke. Brunswick: Fried. Vieweg & Sohn. Price M. 9. (Vol. XV of "Elektrotechnik in Einzel-Darstellungen.")

The question of the design, construction and testing of single-phase and polyphase transformers is fairly fully gone into in this volume. The theory is based on the well-worn assumption of definite coefficients of self and mutual induction and sine-wave supply voltages, but the more important practical effects of the inaccuracies involved in these assumptions are carefully pointed out, and in this way the reader will usually be prevented from going astray. A great many useful practical hints on design are given, and the details of construction are well brought out by the many good illustrations, but the book does not profess to be a complete guide to practical transformer design, so that it is perhaps natural to find the question of the actual dimensions left very hazy, especially as there is still considerable divergence of opinion on this subject amongst different makers.

On the other hand, a number of points are touched on which are not included in the average alternating-current text-book, such as the exact effect of the number and arrangement of the primary and secondary coils on the leakage flux, the effect of the internal electrostatic capacity of the windings of high-pressure transformers, the importance of the type of core joint on the eddy-current loss, the effect of intermittent loading on the temperature rise, and the various possible and impossible connections of three-phase transformers for running in parallel.

The index is altogether insufficient, as a number of points are treated in the book under more or less irrelevant heads, and can only be traced by means of an effective index.

A correction is required to a diagram on p. 58, in which part of the leakage flux is shown as flowing in the opposite direction to the main flux in the core. On p. 186, also, an unworkable suggestion occurs for artificially loading a single-phase transformer by splitting up its secondary winding into two unequal parts and connecting them in opposition. The result of this might be to cause the correct secondary current to flow, but the primary would still carry little more than its no-load current.

Electric Cables: Their Construction and Cost. By D. Coyle, M.I.E.E., and F. J. O. Howe. London: E. and F. N. Spon, Ltd. Price 15s. net.

The book under review is unique in character, and furnishes information of practical value, unobtainable in any previous publication, together with the results of recent researches in cable design.

It is a welcome addition to the literature on electric cables, and the authors are to be congratulated on their production, inasmuch as the data given result from their experience of 46 years (total).

The fact that Mr. Coyle has been in the service of such noted firms as Max Sievert's Fabriks Aktiebolag, Stockholm; Messrs. Siemens Bros. & Co., Ltd., London; Kabelwerk Duisburg; Kabelwerk Oberspree (A.E.G.); and that Mr. Howe has been in the service of Messrs. Siemens Bros. & Co., Ltd., London, and Kabelwerk Oberspree (A.E.G.), enhances the value of the book, and gives authority to the information contained therein.

Engineers engaged in the electrical industry will find the book exceedingly valuable, as it will enable them to determine the dimensions and approximate cost of any type of cable by the use of simple formulæ and tables. The utility of the book is further enhanced by the use of the metric system.

The arrangement of the chapters according to the manufacturing processes is good, but the volume would have been easier to handle if the running title on each page had been replaced by the chapter heading.

Details of the average English and Continental practice are given, together with the recommendations of the various electrical institutions.

Chapter I deals with conductors, and its practical value may be gauged by the following extracts :—

"For rubber-insulated cables it is advisable not to use wires of greater diameter than 2·5 millimetres." "For paper-insulated and other cables it is not advisable to use wires of greater diameter than 4·2 millimetres."

"In the case of extra-high-tension cables, it is very important that curves of small radius be avoided in the periphery of the conductor."

"In some cases it may be advisable to provide the conductor with a circular metallic periphery."

Tables occupying 45 pages are given, showing cross-sectional area in square inches and square millimetres, weight of copper in kilogrammes per kilometre and in pounds per mile, the number and diameters of the wires in the strand. Conversion data are conveniently placed at the end of the tables.

The definition of pitch diameter (page 47) is liable to give an erroneous impression ; it might be amended so as to bring it into line with the calculated data concerning resistance, weight and effective area of strands on page 49.

The physical constants of copper, annealed high-conductivity commercial copper and hard-drawn copper are set out in a concise manner.

Sector-shaped strands are briefly described, attention being called to the inadvisability of employing a true sector on account of the sharp corners damaging the insulating material, and the production of excessive electric stress.

Among the many tables are to be found the following : Weight of copper wire in lb. per nautical mile, Brown & Sharpe or American-gauge wires, Continental normal sections and strands, standard wires and strands, voltage drop in copper conductors, temperature coefficients for copper, and the amount to be added or subtracted from the cost of a cable by a rise or fall in the cost of copper in increments of 1s. from 60s. to 180s. per 100 kg.

Curves relating to the resistance of copper and aluminium conductors to alternating currents are included.

The method of deducing the number and size of wires necessary to form a concentric conductor of any cross-sectional area is given, but no allowance has been made for the reduction in the number and increase in the size of the wires due to the lay.

The physical constants, mechanical tests, and a table giving temperature coefficients of aluminium conclude the chapter.

Impregnated paper insulation and impregnated jute insulation are dealt with in Chapters II and III in a thorough fashion. Tables showing tests of paper, thickness of paper and jute dielectrics for various voltages, data and tables for determining the weight of materials, description of various insulating compounds, curves of dielectric strength and effect of temperature, besides numerous hints, are given.

India-rubber and gutta-percha dielectrics are discussed in Chapter IV, which opens with a short description of the process of manufacture of compound rubber and its application to wires and strands.

Data, tables of weights and temperature coefficients of india-rubber and gutta-percha are included.

The next chapter is devoted to dry-core telephone cables, a comparison being made between the sizes of conductors used in Scandinavia, Germany and England, and short accounts given of the ordinary twin, multiple twin and quadruple types of cables.

The formula from which the diameter of the cables may be determined is based on first principles, and on actual tests of some 500 cables. This is hardly the time or place to enter into an academic discussion on the merits of the formula ; it is sufficient to say that it furnishes an easy means of arriving at the dimensions of the cable in order to obtain approximate costs.

The use of the letter x in the expression—

$$\frac{0{\cdot}02416\ (\text{K}\ x)}{\log_{10}\frac{b^2}{r^2}}$$

is inadvisable, as it has previously been used to represent the strand basis coefficient.

No mention is made of the "wire to earth" capacity and its relation to the "wire to wire" capacity.

A valuable addition to this chapter would be a table giving thickness and weight of paper, or the ratio of paper cross-section to air cross-section, for various sizes of conductors and capacities, but perhaps this information is included in the term "Trade Secret."

We come now to the portion dealing with vulcanised bitumen ; in Chapter VI the composition, methods of applying to the conductor, thicknesses, data for deducing weight, and the physical constants are given.

Tapes and braids are fully discussed in the following chapter.

In Chapter VIII an interesting curve giving the allowance for vena contracta is set out. Tables giving the thickness of the lead sheath according to English and Continental practice, data showing physical constants and mechanical tests, and a table giving weight of lead in lb. per *nautical mile* are included. A "rise and fall in price" table, similar to the one given for copper, would be useful.

Two chapters are devoted to the consideration of steel wire and steel tape armouring.

Labour charges and expense are next dealt with, and the authors have expressed these charges as a percentage on the cost of material, having found from actual costs that the labour varies from 5 to 15 per cent., according to the type of cable. This method is only correct when the materials are worked out at standard prices.

Shop expense is usually taken at 100 to 200 per cent. on the cost of labour, but in Table 129 only 25 to 75 per cent. is included.

For waste of material, 2½ per cent. covers for ordinary cable ; rubber and dry-core cables require an allowance of 5 per cent. Only 2 per cent. has been allowed in Tables 162 to 164.

Examples of detailed estimates for four types of cables are very clearly set out.

The closing chapter deals with cable constants such as self-induction, electrostatic capacity, dielectric resistance, carrying capacity of cables, and voltage stress in alternating-current cables. Details of construction and tests of special cables are given.

Throughout the book prices of the various materials used are stated.

The volume contains no fewer than 216 tables and 69 curves ; from this one may judge the enormous amount of time and labour the authors have devoted to its production. It is well got up, and from its compactness, clearness, and wealth of detail, will be a valuable acquisition to any electrical engineer's library.

Atlas der Elektropathologie. By DR. S. JELLINEK. Berlin : Urban & Schwarzenberg. 1909. Price M. 35.

This is a unique production, giving upwards of 200 illustrations—very many of them in the natural colours—of accidents due to electric shocks on high-pressure systems and to lightning strokes, with brief particulars of the circumstances attending the incidents concerned. The greater part of the work relates to personal injuries, and the originals from which the illustrations were made are preserved in the Electropathological Section of the Museum of the University of Vienna, in the form of casts, specimens preserved in spirit, paintings, photographs, &c. Most of the cases dealt with came under the personal observation of the author ; they include 29 instances of personal injury due to electric currents, one of which was self-inflicted. Explanatory diagrams are given, showing as nearly as possible the position of the sufferer with regard to the electrical circuits, machines, &c., at the moment of receiving the shock. The coloured illustrations, naturally, are in many cases very repulsive—almost sickening, in fact—in aspect, frightful burns being inflicted upon the victims. Microscopic sections of tissues impregnated with volatilised copper, or otherwise affected, are sometimes given. In not a few cases, we are pleased to say, photographs showing the appearance of the sufferers at intervals after the accidents are reproduced, thus indicating that they survived and were restored to health ; but too often the result was death. In addition to the bodily

injuries, many interesting examples of cables and other electrical apparatus destroyed by short-circuits are illustrated, and the effects of lightning discharges upon persons and things are well exemplified. The book is not such as one would care to leave about the house, but must prove of material assistance and value to those whose province it is to investigate the subjects dealt with, and we owe the author and publishers a debt for the admirable manner in which it has been produced.

The Alternating-Current Commutator Motor: The Leakage of Induction Motors. By DR. RUDOLF GOLDSCHMIDT. London: *Electrician* Printing and Publishing Co. Price 6s. 6d.

The subject of single-phase commutator motors is one which undoubtedly requires the full treatment which only a separate treatise permits, but, although the present volume contains a great deal of useful first-hand information, it hardly covers the ground completely enough or in a sufficiently systematic matter to be able to rank as a text-book of the subject. To those not previously familiar with these machines the treatment will often seem obscure, although to the designer the condensed form in which the writer presents the results of his investigations and the numerous tables and curves will prove of great value. The subject, however, justifies an enlargement of the book, so that much more detailed explanations, both of the theoretical effects and of the way in which the tabulated figures have been arrived at, can be included.

In the first chapter the elementary electrodynamic laws and their application to motors are dealt with. Chapter II is divided into nine sections dealing with the plain series motor, first, on the assumption of no losses and no leakage, and then under working conditions. The method of drawing the circle diagram from the test results and from calculation is next outlined. The question of commutation and the effect of the voltage induced in the short-circuited coils by the transformer action of the main flux is then fully gone into, and a simple approximate method of calculating the iron losses in the motor is explained, but it is difficult to estimate its reliability in the absence of any confirmation by actual tests. The question of heating is not considered, perhaps because it does not differ materially from the same problem in connection with the older types of machine, but its importance deserves some reference. Chapter III deals with the plain repulsion motor, and contains a useful comparison between series and repulsion motors. The problem of the size and heating of the commutator of repulsion motors is not discussed.

In Chapters IV and V the Latour-Winter-Eichberg repulsion motor and some other modifications are described, and in Chapter VI illustrations and particulars of a number of actual motors as constructed by Messrs. Siemens, the Oerlikon Co., Kolben & Co., the Westinghouse Co., the General Electric Co., the A.E.G., &c., are given.

The section of about 50 pages on the "Leakage of Induction Motors," at the end of the book, is quite independent, and has no direct reference to commutator motors. It is mainly a reprint of some articles by Dr. Goldschmidt in the *Electrician*. He handles the problem partly by calculation and partly by means of constants derived from tests, and in a manner which, though somewhat less theoretical than that of Adams, is less empirical than that of Behn-Eschenburg or Hobart. The differences between the leakages of single, two and three-phase motors are carefully brought out, and an especially useful section on the effects of the various arrangements of the coil ends is included. No single complete formula for the leakage coefficient is developed (except one for rough preliminary calculations), but, instead, three factors are left in the expression, and the correct values for these have to be picked out of three tables to suit the various cases under consideration. The leakage coefficients calculated by this method for normal designs do not differ markedly from those obtained by Behn-Eschenburg's formula; but the clear insight given into the separate effects of the slot leakage, the zig-zag leakage and the coil-end leakage makes the method safely applicable, even in quite abnormal cases.

A number of minor misprints occur throughout the book, *e.g.*, on p. 87, O A is given in place of O H; on p. 102, "$\frac{1}{2}$ a period" in place of "$\frac{1}{4}$ period"; on p. 103, fig. 112 has one arrow reversed; on p. 115, n occurs twice in place of n_s; on p. 145, fig. 180 is given in place of fig. 177; on p. 175, $\frac{x}{bl}$ is given in place of $\frac{\lambda}{bl}$; on p. 192, $T_K' - T_K''$ occurs in place of $T_K' + T_K''$, &c.

The index could be a good deal extended with advantage, and a table of symbols (preferably with references to the pages on which they are explained) should be provided for the commutator motor section, as it is already for the induction motor leakage section.

THE "FIXED-PRICE" LIGHT.

DURING the past year or two a great deal of prominence has been given to the development of the "small consumer" load by central-station engineers and others, the methods suggested for attaining this very desirable object being the subject of much critical attention on the part of those interested.

Fortunately for the present day movement, sorry attempts with carbon lamps and expensive wiring in the past, account for much of the adverse comment, and those who have recently taken up the subject with metal-filament lamps, and the cheaper, though no less efficient, wiring which is now available, are enthusiastic as to its possibilities.

The most recent move in this direction has been made by the Fixed Price Light Co., Ltd., whose suggestive title carries with it the essence of the company's proposal. The company, which is fathered by Messrs. Siemens Bros. & Co., has adopted the original proposal of Messrs. Handcock & Dykes, and retains that firm as its consulting engineers; its objects are, primarily, to enable tenants or owners of small property to have their premises wired and electrical energy supplied on the basis of an inclusive fixed rental per lamp.

Briefly, the company acts as "middleman," purchasing energy in bulk from any supply authority with whom suitable arrangements can be made; it provides the necessary capital outlay in the form of a "ready-for-use" installation —an arrangement which, of course, avoids the bugbear of initial outlay which the small consumer cannot afford, and which should appeal to many supply authorities, who either have no powers or are not in a favourable position to carry out a scheme of this kind for themselves; incidentally, it relieves the supply undertaking of a great deal of worry, and, as it seems to us, provides the commercial link between the station engineer and the consumer, a link which is too often missing.

The Fixed Price Light Co. will issue specifications to contractors and call for tenders for the wiring of selected houses, &c. The light will be supplied to the tenants at a fixed rental per lamp per week, including fitting up the houses, the first lamps, and the charges due to the supply authority for the energy supplied. When the lamps wear out, new lamps will be supplied by the company, either at the usual retail price or on easy terms. The company will also keep the installation in good order, free of charge, except in respect of breakages.

The company is prepared to receive proposals for wiring, in selected localities, not less than three rooms in any one house, and suitable fuses, switches, shades, lamps, &c., have been designed and standardised for the purpose. The lamp and shade selected will light adequately one room of ordinary size, as generally found on premises of the kind described. The consumer will be expected to use his light reasonably and without waste, and in order to control him in this respect, the company has decided not to include the supply of new lamps in the weekly rental, but to make the consumer pay for these.

The company's initial venture is concerned with property in the Rotherhithe New Road and Waterloo Road districts, where it has opened offices and entered into arrangements with the London Electric Supply Corporation. As regards the former district, through the kindness of the company, we

were enabled on Friday last to inspect the branch office and show house at 141, Rotherhithe New Road, in which case the supply is an alternating one, and is transformed down to 60 volts for use in the house. The wiring throughout is concentric, run on the surface, with single "Stannos" wires, the metal sheath serving as the return conductor.

Tantalum lamps are supplied, with opal reflectors and fitted to ceiling blocks, no flexible being employed; in this particular case the 25-C.P. lamp has been found satisfactory in the larger rooms, but it will be noted that the company undertakes to give an adequate light, which means, presumably, sufficient to satisfy the needs of the consumer.

The scale of charges has been fixed at 2½d. per light per week from April 1st to September 30th, and 3½d. per light per week from October 1st to March 31st—the latter scale working out at only ½d. per night per lamp during the dark winter months.

The arrangements to be adopted by the company for supplying its consumers depend, of course, largely on circumstances, but in the case of the average terrace of small houses it is contemplated to place the main cut-outs, meter and transformer (where used) in locked iron cases, which will, if necessary, be attached to the outside of one of the houses, and from which a common-supply cable will be carried along the front of the terrace, services being teed off to the various houses.

Naturally, the company aims at simplicity, and in this connection the utility of the Stannos system is self-evident. We understand that a man and boy wired the company's show-house in a day, and that the inclusive cost of the installation works out at under 10s. per point.

We need only add that the company is in an excellent position to carry out a scheme of this kind, and if properly supported by the supply authorities, its efforts should help towards the solution of one of the difficulties which face the supplier at the present time.

THE GERMAN ELECTRICAL INDUSTRY.

THE electrical trade in Germany during 1909 was very satisfactory to the leading firms as a whole, although the great hopes which were entertained at the beginning were not realised, owing to the absence of enterprise likely to afford scope for the financial activity of the two trustee banks formed specially for the purpose. Among the events of the year may be recalled the collapse and speedy reconstitution of the Cable Syndicate, with the inclusion of an important outstanding firm; the introduction of a lamp tax, which is, however, said to have been largely equalised by the economy resulting from the adoption of metallic-filament lamps; and the development of power stations or works for the supply of large areas of a scattered character. But the principal event of the year, according to a statement made by a prominent representative of one of the leading manufacturing companies, was the approval in principle, by the Minister for Railways, of the grant of a concession to private enterprise for the construction of a high-speed railway between Cologne and Dusseldorf. Apparently this expression of opinion is based upon the expectation that a development of electric railways will take place when the line in question has actually been built.

The Bergmann Electricity Works Co., of Berlin, which was formed in 1893 with a capital of £50,000, has gradually increased the latter to £1,050,000, and is now raising a 4½ per cent. loan in the form of bonds amounting to £500,000. The issue was sanctioned in May of last year, and is intended to financially equip the company for the work which the electrical industry expects in the coming years, particularly in regard to electric railways.

The Gesellschaft für Luftstickstoff Verwertung (Atmospheric Nitrogen Utilisation Co.), of Wiesbaden, has just resolved upon a fresh scheme of financial reconstruction which, whilst extending the scope of the undertaking, will place it under the control of foreigners. It appears that negotiations were entered into with a German financial group too late to ensure the reorganisation being carried out under Teutonic auspices, and it has therefore been decided to accept offers which will place seven Frenchmen on the board as representing £40,000 of new capital and three directors of Ganz & Co., of Buda-Pesth, as representing £15,000 of new capital.

The directors of the Accumulatoren und Elektricitäts Werke Gesellschaft vorm. W. A. Boese, of Berlin, have issued a circular in reference to a scheme of financial reconstruction. The circular states that the scheme will render £110,000 available which will permit of the disposal of creditors and of the bills in relation to the 13 electricity works built or financed, and will also strengthen the company's working capital.

The shareholders in the Telephonfabrik Gesellschaft vorm. J. Berliner, of Hanover, recently approved the report and accounts for 1908-9, and the payment of a dividend of 11 per cent. on a share capital of £200,000, as compared with 10 per cent. on £150,000 in the preceding year. According to the report, the turnover again increased, the branch establishments were well employed, and Government orders were on hand to a satisfactory extent. Having regard to the new English Patent Act, the London branch had been converted into an independent share company, in which the Hanover company was interested to the amount of the capital hitherto participating in it. The amount expended on patents had been written off. The gross receipts from sales and capital investments amounted to £71,440, as against £59,070 in 1907-8. After meeting working expenses and providing £14,170 for depreciation, as contrasted with £7,750 in 1907-8, the net profits, including the balance forward, reached £31,440, as compared with £22,340 in the previous year. In addition to the ordinary capital, the company has a 4½ per cent. bond issue of £50,000. At the recent meeting it was stated that the course of business was very favourable, and that the home and foreign factories had an abundance of orders on hand.

The Elektrische Licht und Kraftanlagen Gesellschaft, of Berlin, which is an investment company covering electrical undertakings of various kinds in different parts of the world, reports gross profits of £152,950 in 1908-9, as contrasted with £155,700 in the previous 12 months, on an ordinary paid-up capital of £937,500 and a bond issue of £1,243,500. The net profits amounted to £85,200, as against £84,850 in 1907-8, and a dividend has been declared at the rate of 7 per cent., as in each of the four preceding years. It is mentioned in the report that the company took over one-half of the ordinary capital of £225,000 issued by the German Cuban Electricity Co., which was formed last March with the co-operation of the Deutsche Bank for the acquisition of the electricity works at Cardenas, Guanabacoa and Matanzas. The remainder of the purchase price of the Brazilian Electricity Co., of Berlin, had been taken over during the year by the Brazilian Securities Co. An English banking group had granted an advance of £300,000 to the Empresas Electricas Asociadas, of Lima, Peru, and the Licht and Kraft Co. had accepted a sub-allotment of £15,000 out of the total. The banking group had secured an option which had to be exercised by the end of January, 1910, on a 6 per cent. loan of £1,000,000. An attempt was made at the recent meeting to secure an increase in the proposed dividend, but this was unsuccessful, and it was stated that the company followed the principle of the Deutsche Bank in the sense of paying constant dividends, and of only augmenting them when the company was so strongly fortified that, as far as human calculation went, a reaction was no longer to be expected.

Siemens Elektrische Betriebe Gesellschaft, of Berlin, which is wholly concerned with the working of its own or leased generating stations and tramways both in Germany and other countries in Europe, realised gross profits of £52,770 from these undertakings in 1908-9, as contrasted with £50,520 in the preceding year, whilst interest yielded £24,230, as against £14,200 in 1907-8. After making provision for the interest service on the bond capital of £682,500, as compared with £577,000 in the previous year, meeting administrative expenses, writing off £13,180 for the depreciation of electricity works and placing £5,240 to the renewal fund, the accounts show net profits of £25,990, as against £25,620 in 1907-8. This surplus has allowed of the payment of a dividend at the rate of 6 per cent. on the ordinary share capital of £375,000, being the same as in each of the two preceding years. It was mentioned at the recent meeting that the concession received from the Government for the power station on the Wiesmoor in East Friesland, which was carried out by the Siemens-Schuckert Works, was for a period of 65 years. A second concession of a similar kind had just been obtained from the State of Lübeck, where the projected station would supplement the Lübeck municipal station, which could not be further extended, and all the Lübeck towns would be gradually connected with the new works. It was added that the prospects for the current year were favourable, as the receipts of the individual works indicated an expansion.

The Gesellschaft fur Elektrizitäts Anlagen, of Berlin, which owns various electric supply works, and is financially interested in others, records gross profits of £33,310 for 1908 9, as against £22,100 in the preceding year. Including the balance forward the net profits amounted to £26,930, as compared with £20,540 in 1907-8. It is proposed to pay a dividend of 6 per cent. on the share capital of £350,000, this contrasting with 6 per cent. on £250,000 in 1907-8. The undertakings owned by the company stand at £130,000, as compared with £123,500 in the previous year, the increase being due to extensions carried out at the Sassnitz works.

Various Dividends.

	1908-9.	1907-8.
E. H. Geist Elektrizitäts Gesellschaft ...	Nil.	Nil.
Fabrik Isolierter Drähte (Vogel)	2 %	3 %
Elektrizitätswerk Berggeist	4 %	2 %
Rheinische Schuckert Gesellschaft	7 %	7 %

The liquidation of the Helios Elektrizitäts Gesellschaft, of Cologne, whose manufacturing works were disposed of to two of the principal firms a few years ago, and which is now only financially concerned with various supply works, has not yet been brought to a conclusion. According to the liquidator's report for 1908 9, the profit and loss account closed, as in the preceding year, with a loss of £419,000. A year ago an offer was made to take over the whole

of the assets, which would have permitted of a settlement with the bond-holders and creditors to the amount of 67½ per cent. of their claims, but the proposal was declined. Now a new offer is under consideration, which suggests the transfer on the basis of 83½ per cent. of these claims, whilst the shareholders, although having no legal claim, would receive 4 per cent. of their holdings if the scheme is brought to a successful issue.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

MEXICO.—It is imperative that the exact net and gross weights in kg. should be marked on each package and specified on invoices, bills of lading, and certificates of origin. The net weight in kg. of each class of goods should be given, and the origin of the goods declared in all documents. The marks and numbers must be stencilled. Invoices in quaduplicate, signed by the Consul, must be made out in Spanish or English on special forms; also one copy of merchant's invoice, which must have the following declaration below the total of the invoice:—

On each of the Consular invoices:

I (we) hereby declare that I (we) proceed with all legality and good faith. (Signature.)

Dated at (London).

On the mercantile invoice:

I (we) hereby declare on my (our) responsibility that the amount of £ s. d. mentioned in this invoice is true and correct. (Signature.)

Dated at (London).

In case the shipping agents are unable to produce the mercantile or manufacturers' invoice, the following declaration must be made on all four copies of the Consular invoices:—

I (we) hereby declare that I am (we are) unable to present the mercantile invoice of the within-named goods, and therefore attest on my (our) responsibility that the total amount of £ s. d. is their true and correct value.

Dated at (London).

(Signature and address.)

Documents should be lodged at the Consulate the day before the steamer sails, otherwise a fine is imposed on late documents. If Consular invoices are presented for legalisation 48 hours after sailing of the vessel, a double fee is charged. The fees charged by Consuls for legalising invoices are: 8s. for goods to a value of £20, 16s. for goods to a value of £200, and 4s. extra for every additional £100.

Consular invoices should specify not only the place of destination in the interior of the country, but also the port by which the goods are to enter the Republic.

Until December 14th, 1913, the Mexican Government is authorised to accord to companies investing not less than 100,000 pesos in the establishment and working of industries which are entirely new in the Republic, exemption from Customs duty in respect of all machinery, apparatus, tools and appliances, and construction materials necessary for the establishment of the industry and the erection of the works. Concessionaires are required to furnish a bond in each case covering the goods thus introduced, which will be cancelled as soon as the machinery has been erected or proof furnished that the apparatus, tools and materials have been used for the purpose for which they were ostensibly imported.

(To be continued.)

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1. "Improvements in portable telephones and electric batteries therefor." W. K. L. DICKSON. January 1st.

40. "Improvement in change-over switches, auto-starter switches and such like." J. R. JENKINS. January 1st.

65. "Improvements in or relating to relays for telephone or other weak current apparatus." C. STILLE. (Date applied for under Sec. 91 of the Act, January 12th, 1909, being date of application in Germany.) January 1st. (Complete.)

66. "Improvements in the manufacture of electrodes for secondary batteries." SERGE BERDITSCHEWSKY APOSTOLOFF and V. DE KARAVODINE. January 1st.

71. "Improvements in and relating to electric welding." E. B. KOOPMAN. January 1st.

97. "Improvements in holders for glow lamps for use on motor-cars or other purposes." A. G. BENSTEAD and E. ARON. January 1st.

101. "Improvements in electro-magnetic signalling devices for selectively operating two or more alternate signals or indicators using one live wire and earth or two wires only." J. WILLIS and B. JOHNSON. January 3rd.

122. "Process for electrically sizing, filling and colouring paper." F. ARLEDTER. January 3rd.

150. "Improvements in fittings for electric lamps and the like." N. W. PRANGNELL. January 3rd.

187. "Improvements in signalling by electromagnetic waves." R. A. FESSENDEN. (Date applied for under Sec. 91 of the Act, January 18th, 1909, being date of application in United States.) January 4th. (Complete.)

205. "Improvements in or relating to starting switches for electric motors." W. R. ANSELL. January 4th.

211. "Improvements in and relating to protective devices of the type known as lightning arresters." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 4th.

219. "Combined adjustable support and contact device for electrically-driven fans." J. BEIN. January 4th.

229. "Improvements in and relating to transmitters of distant transmission devices and the like." H. CARBONNELLE. (Date applied for under Rule 13, August 25th, 1909. An invention comprised in application No. 19,516 dated August 25th 1909. Application for patent of addition to No. 5,187 of 1907.) January 4th. (Complete.)

255. "Improvements in electric arc lamps." A. KERSHAW. January 5th.

282. "Improvements in devices for making temporary electric contacts." EDWARD, FREIHERR VON MAIRHOFEN and M. STEIN. January 5th.

286. "Improvements in devices for electrically-kindling gas burners." SOCIETE AUBERT FRERES. (Date applied for under Sec. 91 of the Act, March 13th, 1909, being date of application in France.) January 5th. (Complete.)

293. "Improvements in or relating to trolley poles for electric cars." F. G. YEO. (P. A. Robertson, South Africa.) January 5th.

339. "Improvements in sparking plugs." H. G. LONGFORD. January 6th.

349. "Metal-filament lamps having filament carriers arranged elastically." O. KRAUSE. (Date applied for under Sec. 91 of the Act, July 5th, 1909, being date of application in Germany. An invention comprised in application No. 22,458 of October 2nd, 1909.) January 6th. (Complete.)

350. "Metal-filament lamps having filament carriers arranged elastically." O. KRAUSE. (Date applied for under Sec. 91 of the Act, July 7th, 1909, being date of application in Germany. An invention comprised in Application No. 22,458 of October 2nd, 1909.) January 6th. (Complete.)

361. "Improvements relating to the electrical transmission and reception of signals, drawings, photographs and the like." T. T. BAKER. January 6th.

373. "Improvements in apparatus for automatically recording intervals of time between the passage of trains on a track and the speed of the trains." SIEMENS & HALSKE AKT-GES. (Date applied for under Sec. 91 of the Act, March 25th, 1909, being date of application in Germany.) January 6th. (Complete.)

380. "Improvements relating to field magnets for electrical machines." J. FILLIOL. January 6th.

383. "Improvements in the manufacture of electrodes for primary and secondary batteries, and for use in electrolytic apparatus." P. MARINO. January 6th.

402. "Improvements in switches for electricity and gas." A. E. LAMKIN and L. HUNTER. January 6th.

406. "Electro Calisthenic exercise." W. M. BUCKLEY. January 7th.

408. "Improvements in or relating to the electrolytic manufacture of salts of heavy metals which are insoluble or hardly soluble in the electrolyte." C. LUCKOW. January 6th. (Complete.)

415. "Improved device for attaching reflectors or shades to electric lamp-holders." K. J. ESKRIGGE. January 7th.

435. "Improvements in or connected with electricity meters." J. H. BOWDEN and A. H. JACKS. January 7th.

436. "Improvements in or connected with couplings, clips, or jointings for canvas, rubber, flexible, metallic, or other tubing, and also electric cables and fittings." G. H. HALL and J. W. LONGSTAFF. January 7th.

439. "Electric light bracket for hospital operation theatres and elsewhere." A. W. DOWN and H. V. DOWN. January 7th. (Complete.)

457. "Improvements in electric hoists." H. J. MARSHALL. January 7th. (Complete.)

466. "Improvements in telephone receivers." SIEMENS BROS. & Co., LTD., and C. R. RIBER. January 7th. (Complete.)

467. "Improvements in telephone apparatus." SIEMENS BROS. & Co., LTD., and C. R. RIBER. January 7th. (Complete.)

504. "Improvements in and connected with thermostats." E. K. DUTTON. January 8th.

541. "Device for opening and shutting the gasway of burners by means of electricity." C. WILHELM. January 8th.

548. "Improvements in or relating to batteries." T. W. BYRNE. January 8th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

ELECTRIC DIAL MOVEMENT. W. S. Steljes. 25,577. November 27th. (Post-dated May 22nd, 1909.)

MAGNETIC SEPARATORS. F. Powell. 27,020. December 12th.

TELEPHONE EXCHANGE SYSTEM. E. E. Clement. 27,189. December 14th.

SWITCH FOR OPENING OR CLOSING ELECTRIC CIRCUITS. O. Baker. 27,168. December 15th. (Post-dated May 25th, 1909.)

ELECTRIC SWITCH MECHANISM. J. Marshall. 27,244. December 15th.

TROLLEYS OR COLLECTORS FOR ELECTRIC TRAMCARS. T. Holdsworth. 27,822. December 22nd.

MEANS FOR GOVERNING THE SPEED OF ALTERNATING-CURRENT COMMUTATOR MACHINES. H. Jacoby. 27,967. December 23rd. (Application for Patent of Addition to No. 20,495/07.)

1909.

ELECTRIC FUSES. O. Engel. 12,433. June 8th.

ELECTRIC DYNAMOS AND MOTORS. H. B. van Daalen. 15,091. June 28th.

APPARATUS FOR THE PRODUCTION OF ELECTRIC ARCS INTENDED FOR THE FORMATION OF COMPOUNDS OF OXYGEN AND NITROGEN. P. Bunet and A. Badin. 16,225. July 12th. (Date applied for under International Convention, November 30th, 1908.)

MANUFACTURE OF ELECTRIC INCANDESCENCE LAMP FILAMENTS. C. H. Weber. 16,328. July 13th.

ELECTRIC FURNACES. Aktiebolaget Elektrometall. 17,342. July 26th. (Date applied for under International Convention, August 1st, 1908.)

STOP FOR THE JACK SPRINGS OF TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 17,994. August 4th.

AERIAL RESONATOR FOR RECEIVING APPARATUS OF ELECTRICAL WIRELESS SYSTEMS. C. Bardeloni. 24,187. October 21st.

SINGLE-PHASE SERIES-WOUND ELECTRIC MOTOR. F. Punga. 133. January 2nd. (Date applied for under International Convention, January 2nd, 1908.)